

# Introduction to Geographic Information Systems And Agricultural Applications

## USAIN 2008



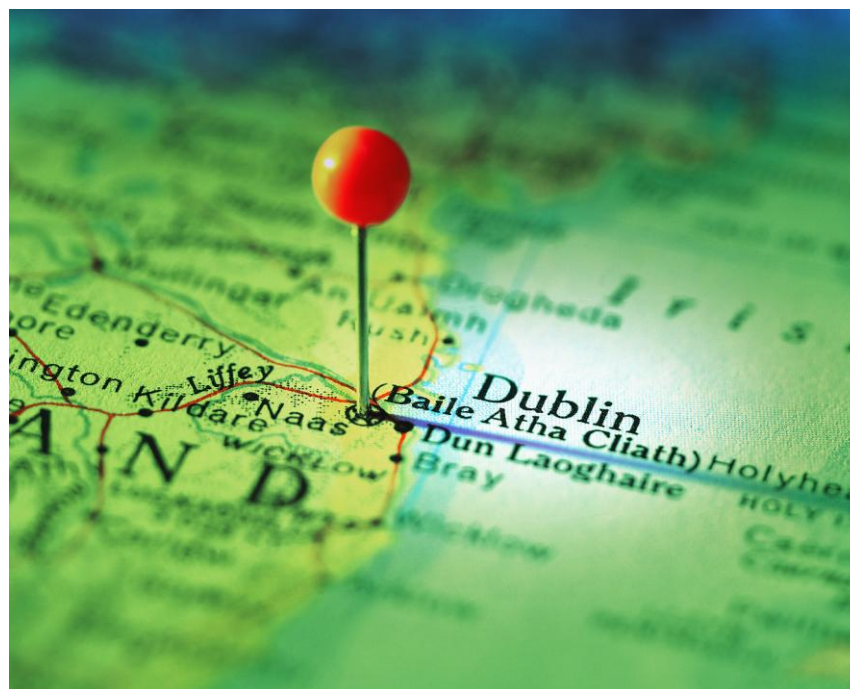
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## Plan For The Day – USAIN Pre-Conference GIS Workshop

- |                                         |               |
|-----------------------------------------|---------------|
| • Welcome and Introductions             | 8:00 – 8:15   |
| • The fundamentals of GIS               | 8:15 – 9:15   |
| • Data sources and Web Mapping Services | 9:15 – 10:00  |
| • Break                                 | 10:00 – 10:30 |
| • Demos and Exercise                    | 10:30 – 11:30 |
| • Agricultural Applications             | 11:30 – 11:45 |
| • Questions/final thoughts/wrap up      | 11:45 – 12:00 |



# Introduction to Geographic Information Systems: Basic Elements and Concepts

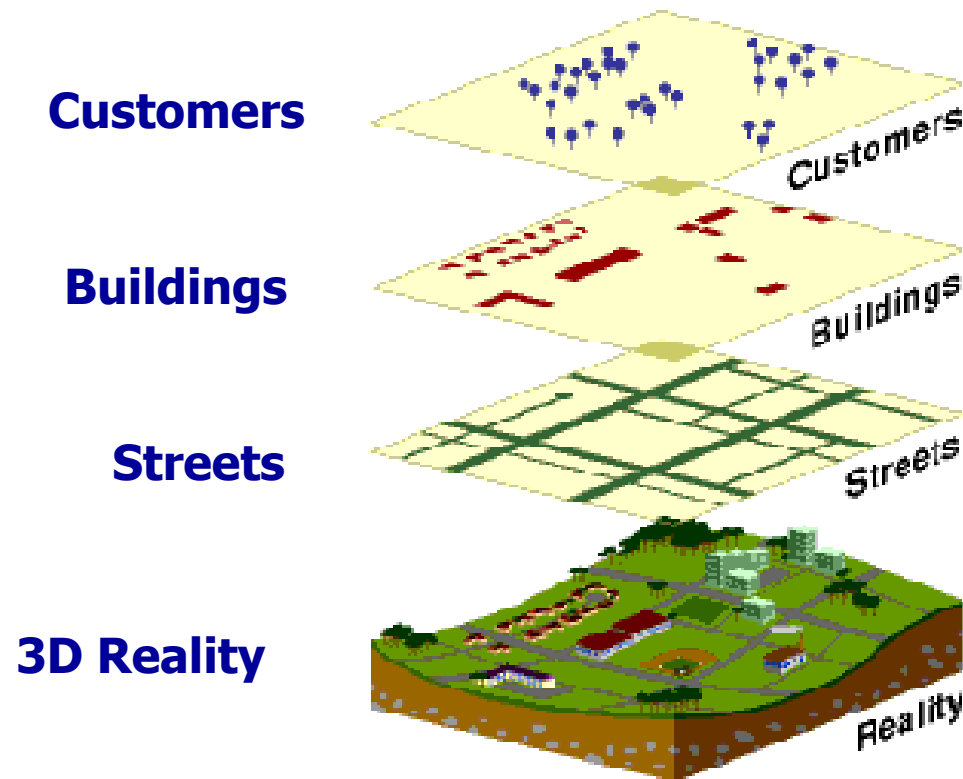


## What is GIS?

A collection of computer hardware, software, data, methods and people used to capture, store, manage, manipulate, analyze, and display all forms of geographically referenced information.

# Geographic Information Systems (GIS) Elements and Concepts

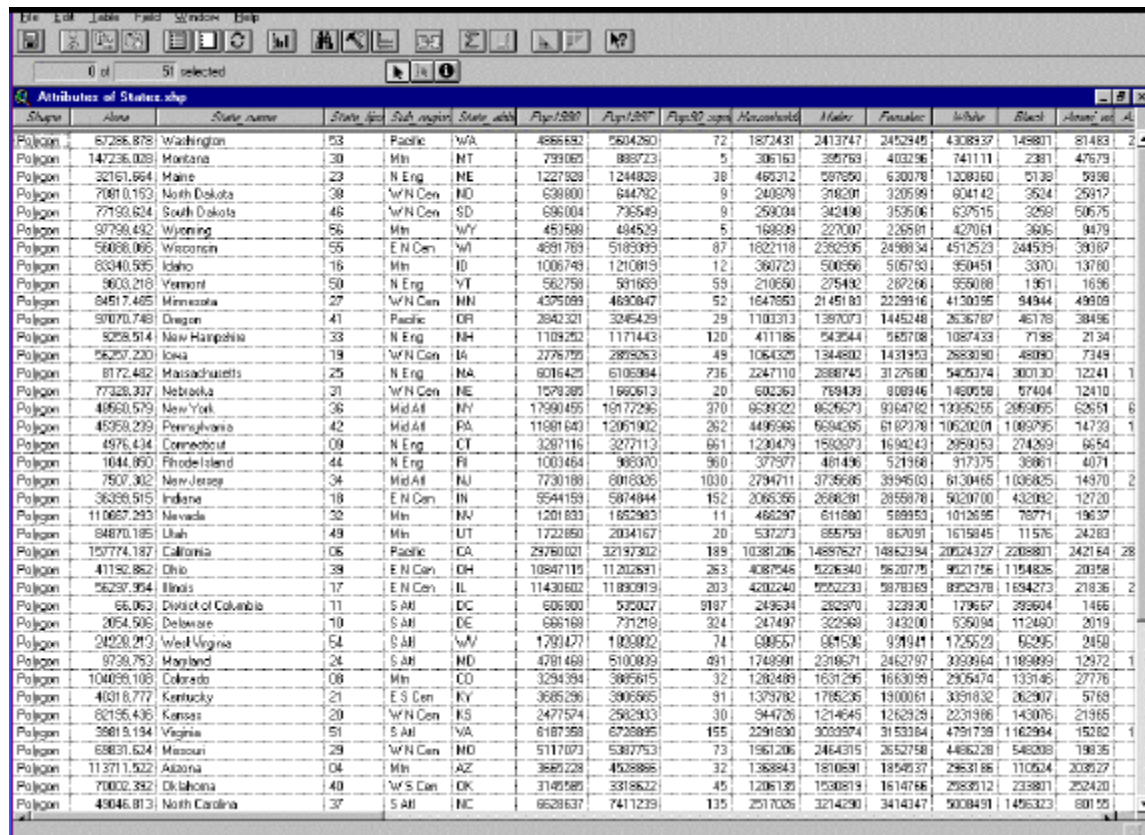
A GIS combines layers of information about a place to enable a better understanding of that place.



# Geographic Information Systems (GIS) Elements and Concepts

## How a GIS Works

Database: Not easy to interpret



The screenshot shows a GIS software window titled "Attributes of States.shp". The window displays a table with columns for various state attributes. The table is sorted by "Shape" and shows 51 rows of data, one for each state. The columns include: Shape, Area, State\_name, State\_fips, Sub\_region, State\_abbr, Pop1980, Pop1990, Pop92\_age, Nonwhite, Male, Female, White, Black, Asian, and A. The data is presented in a grid format with alternating row colors for readability.

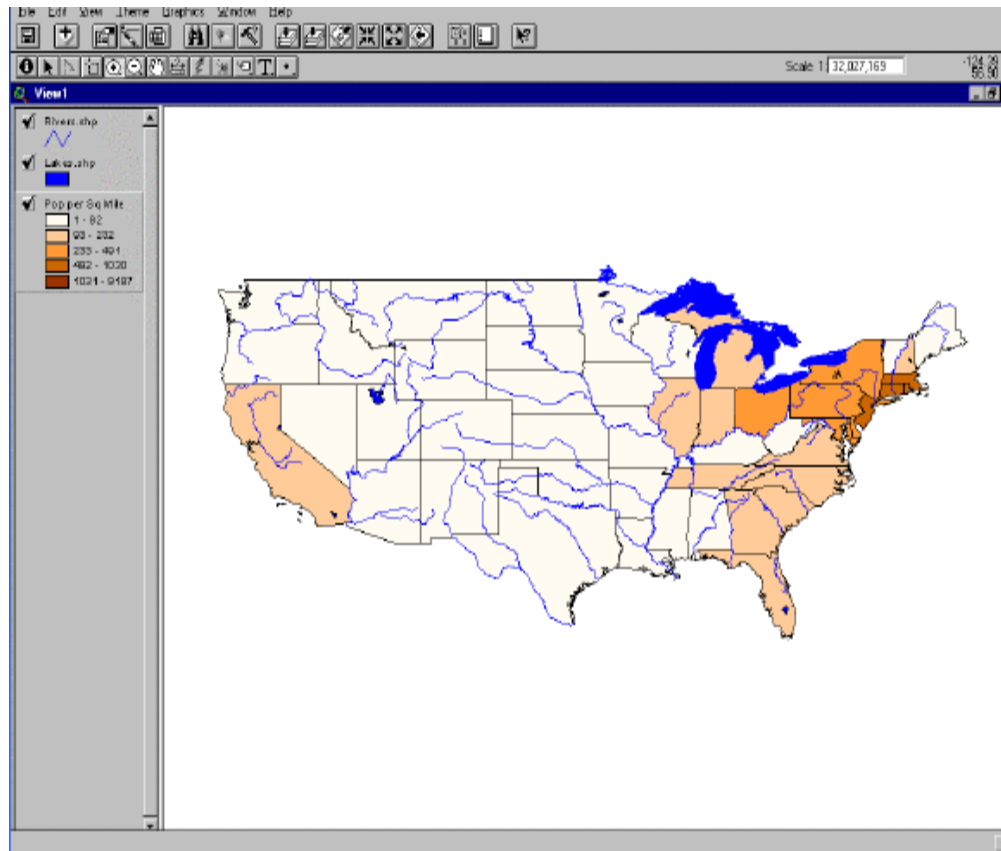
Shape	Area	State_name	State_fips	Sub_region	State_abbr	Pop1980	Pop1990	Pop92_age	Nonwhite	Male	Female	White	Black	Asian	A
Polygon	67266.878	Washington	53	Pacific	WA	4866492	5604260	72	1872431	2413747	2452945	4308937	149801	81483	2
Polygon	147236.003	Montana	30	Min	MT	299065	883723	5	306163	385763	403296	741111	2381	47679	
Polygon	32161.664	Maine	23	N Eng	ME	1227928	1244828	38	465312	597590	630078	1208160	5138	5938	
Polygon	2081.0193	North Dakota	38	NW Cen	ND	638800	644782	9	240379	318201	320599	904142	3524	25917	
Polygon	77193.624	South Dakota	46	NW Cen	SD	696004	735549	9	250304	342490	353506	637515	3259	50675	
Polygon	97799.492	Wyoming	56	Min	WY	453588	494529	5	169309	227007	235801	427061	3606	9479	
Polygon	56068.065	Wisconsin	55	EN Cen	WI	4691769	5183395	87	1622118	2382305	2498834	4512523	264533	39087	
Polygon	63940.935	Idaho	16	Min	ID	1006749	1210819	12	360723	500556	516753	950451	3370	13760	
Polygon	9603.216	Vermont	50	N Eng	VT	562758	591695	59	210560	275492	287266	955088	1951	1656	
Polygon	84517.445	Minnesota	27	NW Cen	MN	4375093	4630847	52	1647853	2145183	2229916	4130395	54944	49909	
Polygon	90770.748	Oregon	41	Pacific	OR	2842321	3245429	29	1100313	1397073	1445248	2636787	46178	38496	
Polygon	9258.914	New Hampshire	33	N Eng	NH	1109252	1171443	120	411186	543544	565708	1087433	7198	2134	
Polygon	56297.220	Iowa	19	NW Cen	IA	2776729	2895263	49	1064329	1344802	1431953	2689090	48080	7349	
Polygon	8172.482	Massachusetts	25	N Eng	MA	6016425	6106984	236	2247110	2688745	3127680	5425374	300130	12241	1
Polygon	77328.337	Nebraska	31	NW Cen	NE	1579389	1692613	20	602363	759439	808946	1460558	57404	12410	
Polygon	48660.579	New York	36	Mid Atl	NY	17990455	19177296	370	9539322	9526573	9916782	13985255	2693005	62651	6
Polygon	45358.293	Pennsylvania	42	Mid Atl	PA	11981643	12061902	262	4499368	6594295	6782781	10620201	1089395	14733	1
Polygon	4976.434	Connecticut	09	N Eng	CT	3287116	3277113	661	1200479	1502673	1698243	2650453	274269	6654	
Polygon	1044.060	Rhode Island	44	N Eng	RI	1003464	983070	960	377507	481496	521968	917375	36861	4071	
Polygon	7507.302	New Jersey	34	Mid Atl	NJ	7730188	8918306	1030	2794711	3735685	3949603	6130465	1036825	14970	2
Polygon	36396.915	Indiana	18	EN Cen	IN	5544159	5874944	152	2065366	2688281	2855878	5020700	432082	12720	
Polygon	110657.283	Nevada	32	Min	NV	1201833	1652983	11	466297	611680	688953	1012695	78771	19637	
Polygon	84870.185	Utah	49	Min	UT	1722850	2304167	20	537273	685758	867091	1675845	11576	24283	
Polygon	157774.187	California	06	Pacific	CA	29780021	32197302	189	10381206	14887527	14862384	20524327	2208801	242164	28
Polygon	41192.862	Ohio	39	N Eng	OH	10847115	11202691	263	4087548	5226340	5620775	9021756	1154838	20358	
Polygon	56297.954	Illinois	17	EN Cen	IL	11430602	11890919	203	4202240	5252233	5878369	8952978	11694273	21836	2
Polygon	66.063	District of Columbia	11	S Atl	DC	606900	575027	9187	249634	282370	323930	179667	298604	1466	
Polygon	2054.505	Delaware	10	S Atl	DE	688169	771218	324	247497	322988	343200	636094	112480	2019	
Polygon	24228.213	West Virginia	54	S Atl	WV	1799127	1803892	74	688557	981506	979141	1725529	62955	2450	
Polygon	9728.753	Maryland	24	S Atl	MD	4781469	5100899	491	1749391	2318671	2462797	3309694	1189899	12972	1
Polygon	104098.108	Colorado	08	Min	CO	3294394	3805615	32	1282489	1631296	1633099	2905474	133146	27776	
Polygon	4631.6777	Kentucky	21	ES Cen	KY	3665296	3905995	91	1379782	1765236	1900061	3391632	262307	5769	
Polygon	82136.435	Kansas	20	NW Cen	KS	2477574	2582933	30	944726	1214645	1262829	2231986	143076	21965	
Polygon	3681.9194	Virginia	51	S Atl	VA	6187589	6738895	155	2291630	3033974	3153384	4791739	1162994	15282	1
Polygon	68831.624	Missouri	29	NW Cen	MO	5117103	5387753	73	1961206	2464315	2652758	4486228	548208	19835	
Polygon	11371.522	Arizona	04	Min	AZ	3685228	4528886	32	1368843	1810691	1859937	2963186	110624	203727	
Polygon	70002.382	Oklahoma	40	NW Cen	OK	3149585	3318622	45	1206139	1530819	1614786	2988012	233801	252420	
Polygon	49046.813	North Carolina	37	S Atl	NC	6528637	7411239	135	2517025	3214290	3414347	5008491	1495323	60155	



# Geographic Information Systems (GIS) Elements and Concepts

## How a GIS Works

Visualization: “Worth a thousand words”



## What is NOT GIS?

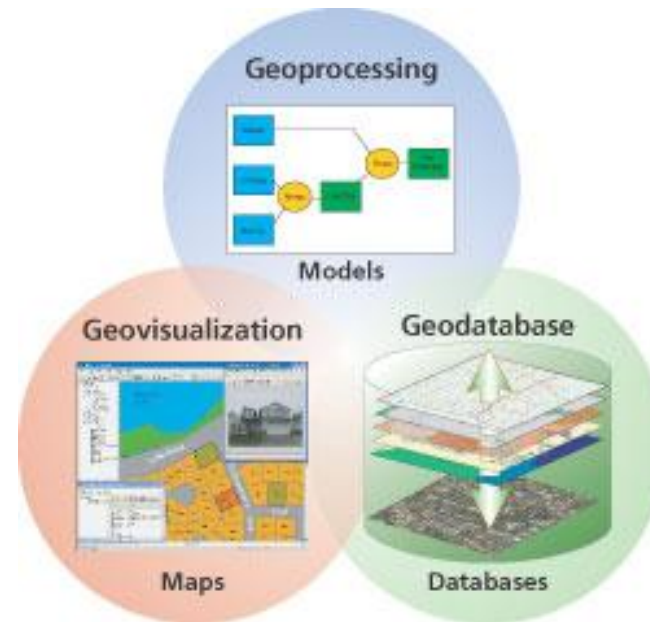
- GPS (Global Positioning System)
- A Map (paper or digital)
  - Maps are often a product of a GIS
  - A way to visualize the *analysis*
- A **software** package



# Geographic Information Systems (GIS) Elements and Concepts

## Three Views of GIS

- 1) **Database View:** database for storing and managing information.
- 2) **Analysis View:** a tool for finding answers to questions.
- 3) **Visualization View:** a tool for creating maps.



# Geographic Information Systems (GIS) Elements and Concepts

## GIS Functions

**Capture:** "Getting the data in". Digitizing hardcopy, integrating GPS points, import from vendors, clearinghouses or government sources.

**Store:** Raster and Vector formats

**Query:** Ability to extract info about features — either directly on the map (by clicking) or by querying the database table for a value (ex: counties with a population > 1 million) with a simple SQL statement.

**Analyze:** 3 groups of analysis

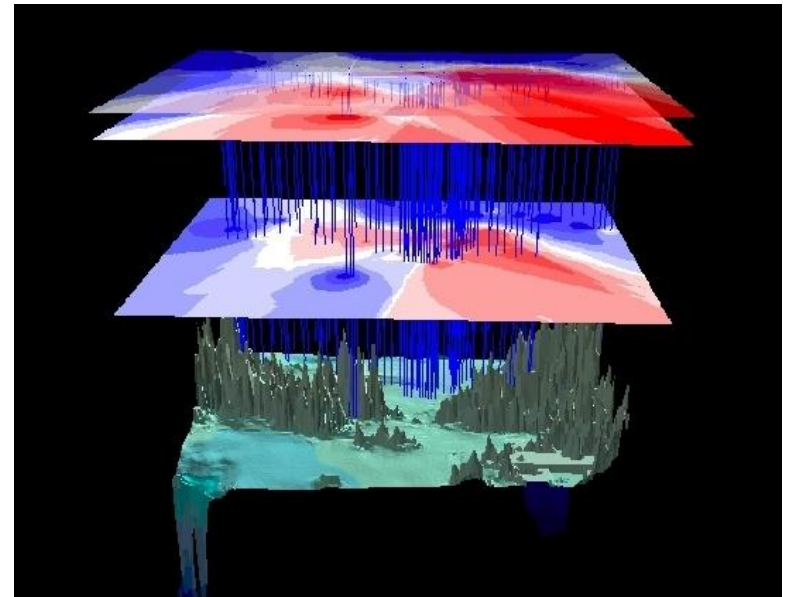
1. **Proximity:** how close or far one feature is to another.
2. **Overlay:** different layers of information and how they interact/relate.
3. **Network:** Finding the best route from point A to point B.

**Display:** Show results visually! The ability to view tabular data in graphical form (on a map).

**Output:** Multiple output formats for sharing data and information: new derived data, images, paper maps, web mapping services, reports, map files (.mxd's to share from desktop to desktop).

## How to use a GIS (6 ways)

1. Mapping where things are
2. Mapping quantities
3. Mapping densities
4. Finding what's inside
5. Finding what's nearby
6. Mapping change



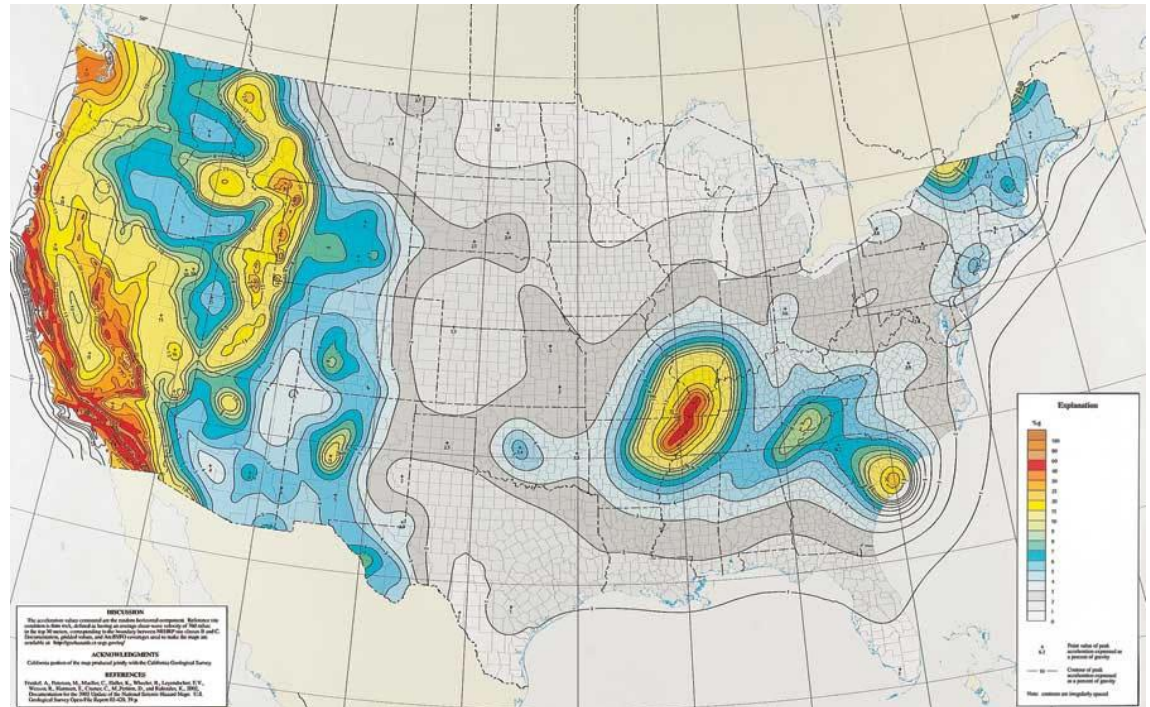
# Geographic Information Systems (GIS) Elements and Concepts

## Mapping where things are

Mapping where things are lets you find places that have the features you are looking for.

- Find Features
- Find Patterns

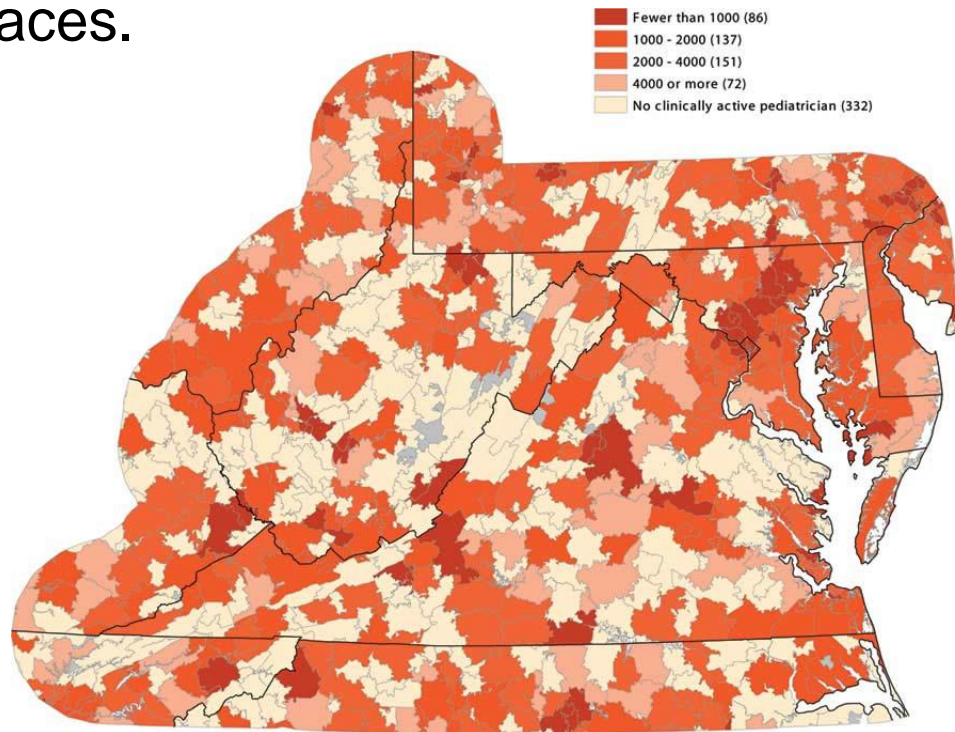
Map of the locations of earthquake shaking hazards: This information is essential to create and update building codes used in the United States.



# Geographic Information Systems (GIS) Elements and Concepts

## Mapping quantities

People map quantities, such as where the most and least are, to find places that meet their criteria or to see the relationships between places.

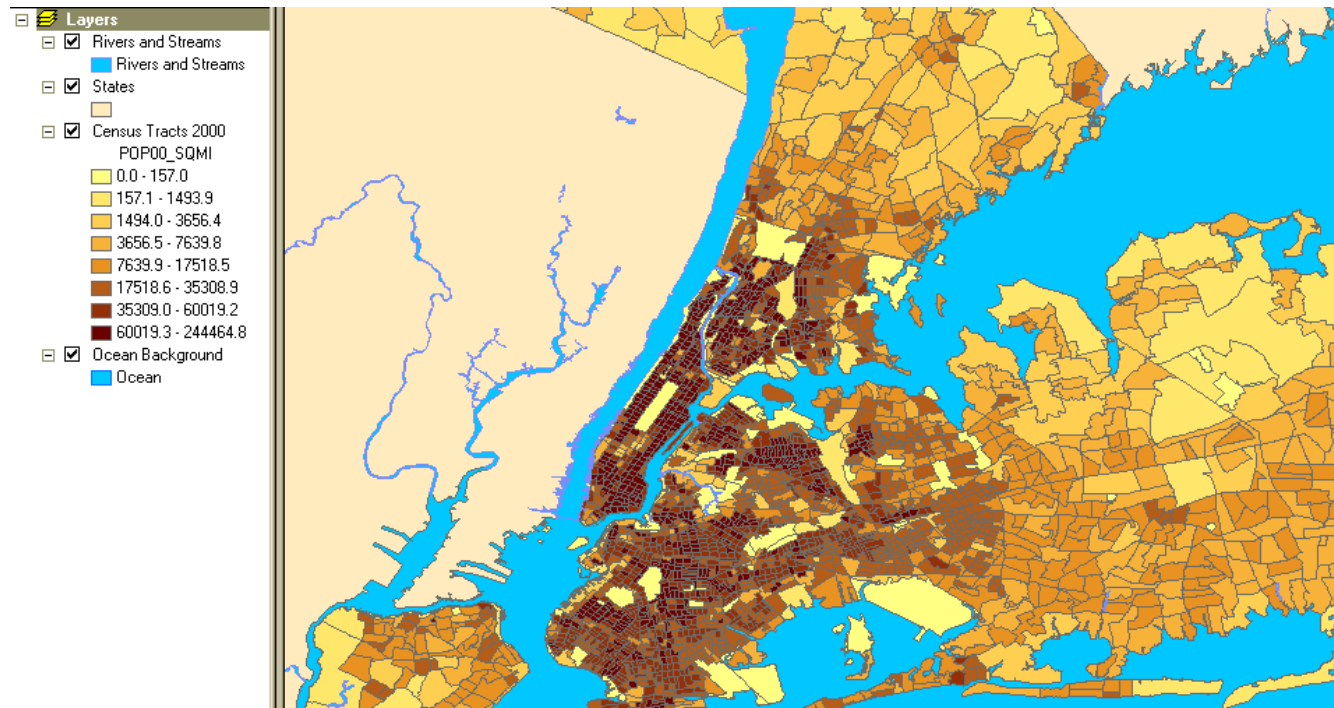




# Geographic Information Systems (GIS) Elements and Concepts

## Mapping densities

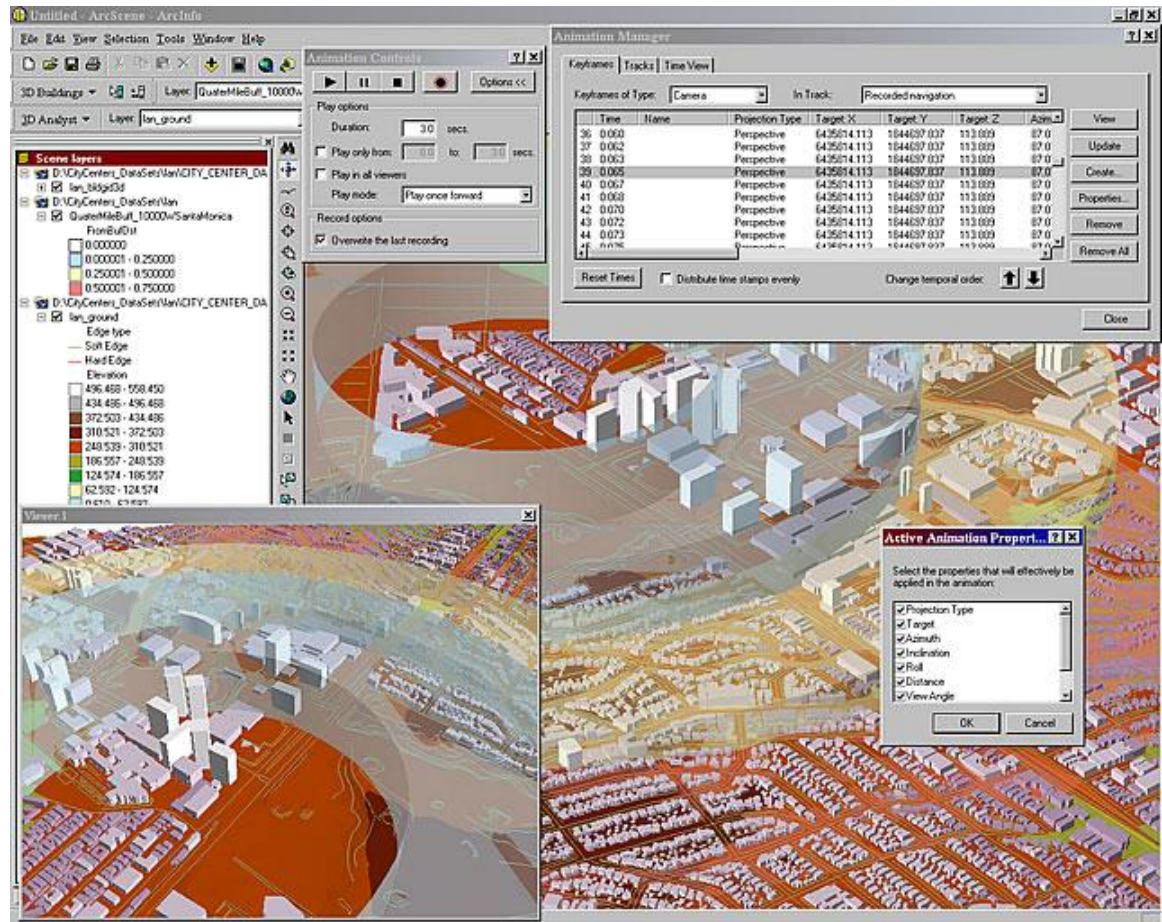
While you can see concentrations by simply mapping the locations of features, in areas with many features it may be difficult to see which areas have a higher concentration than others.



# Geographic Information Systems (GIS) Elements and Concepts

## Finding what's inside

Use GIS to monitor what is happening by mapping what is inside a specific area.

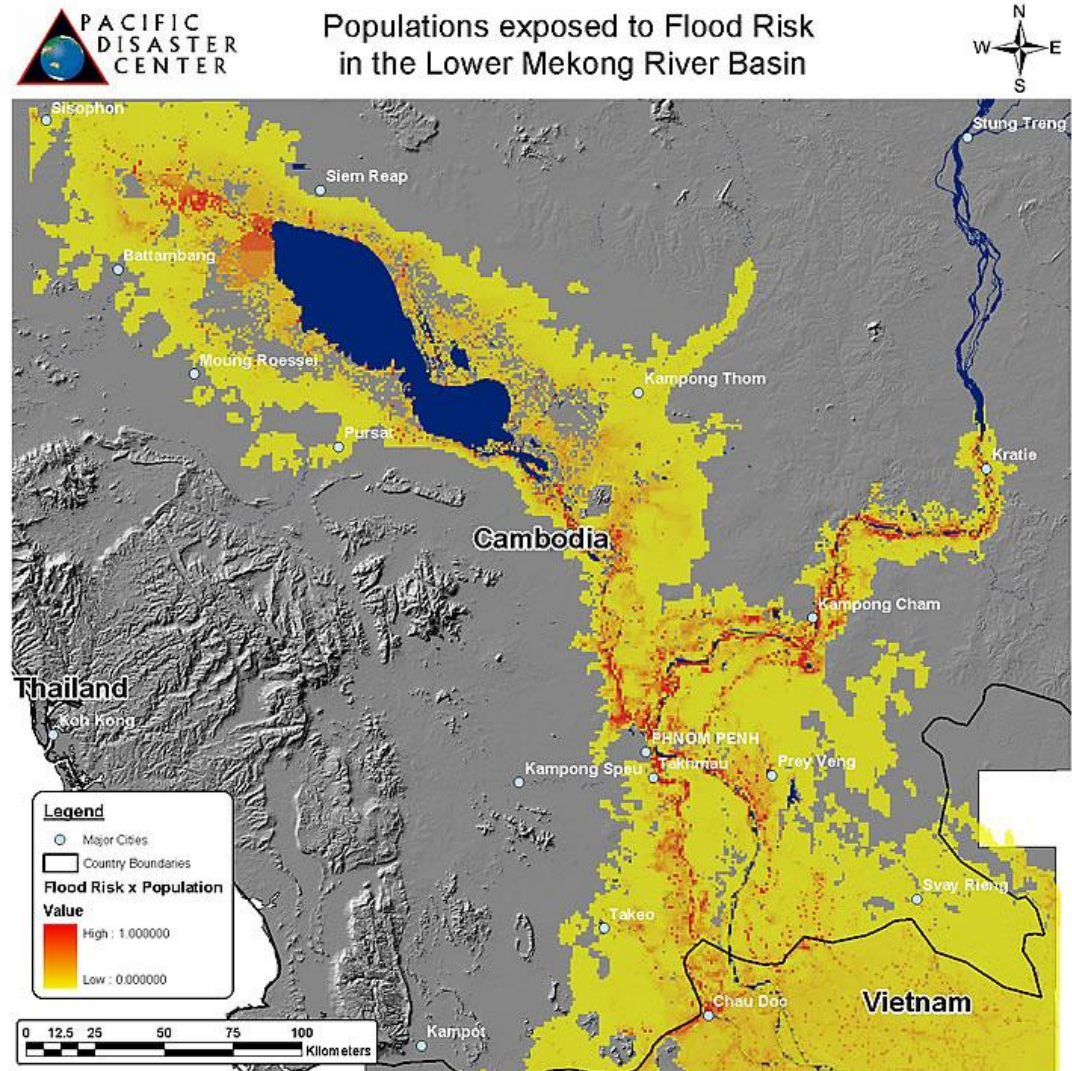




# Geographic Information Systems (GIS) Elements and Concepts

## Finding what's nearby

Find out what is occurring within a set distance of a feature by mapping what is nearby.

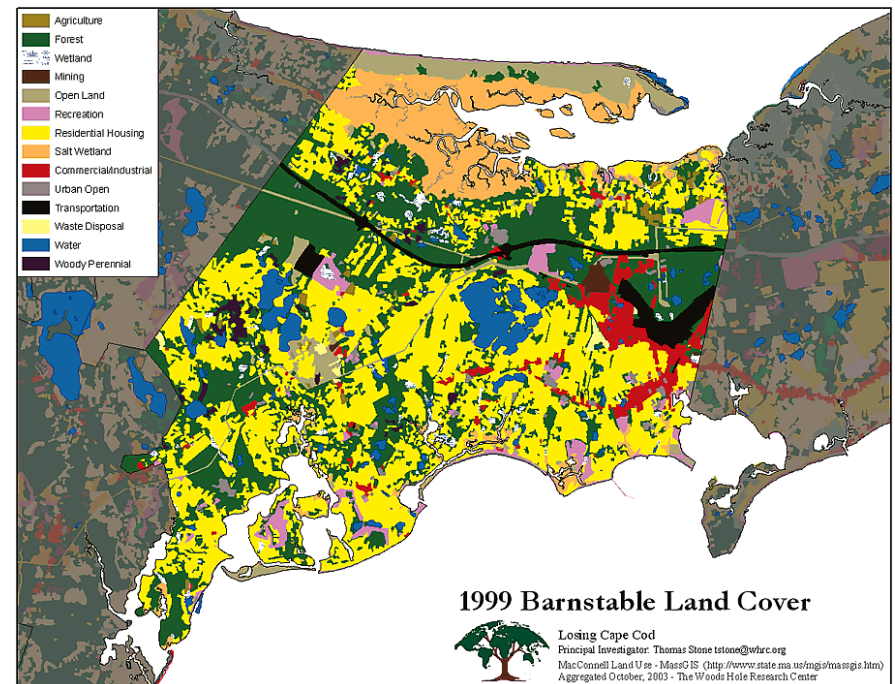
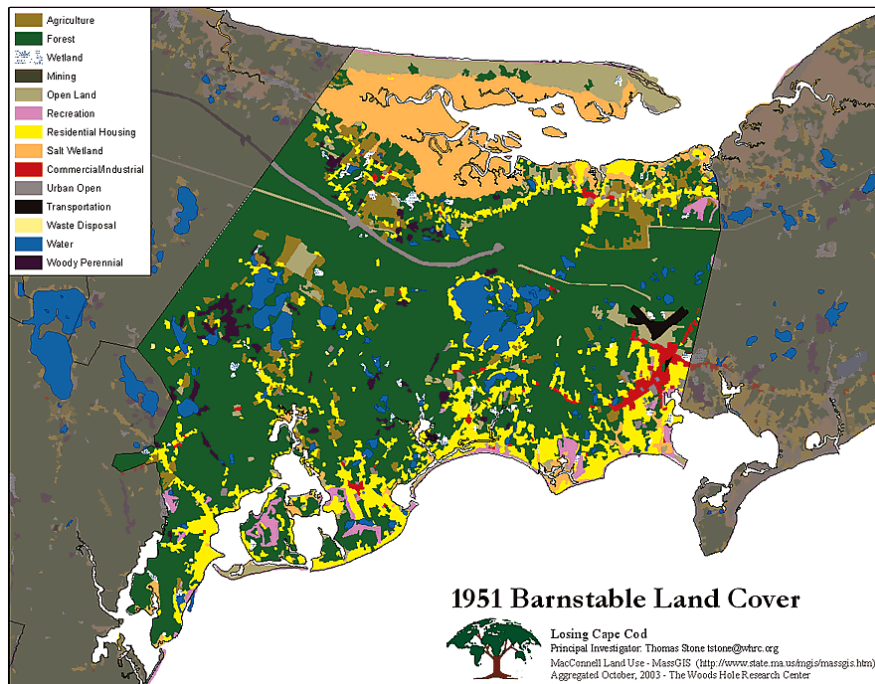




# Geographic Information Systems (GIS) Elements and Concepts

## Mapping change

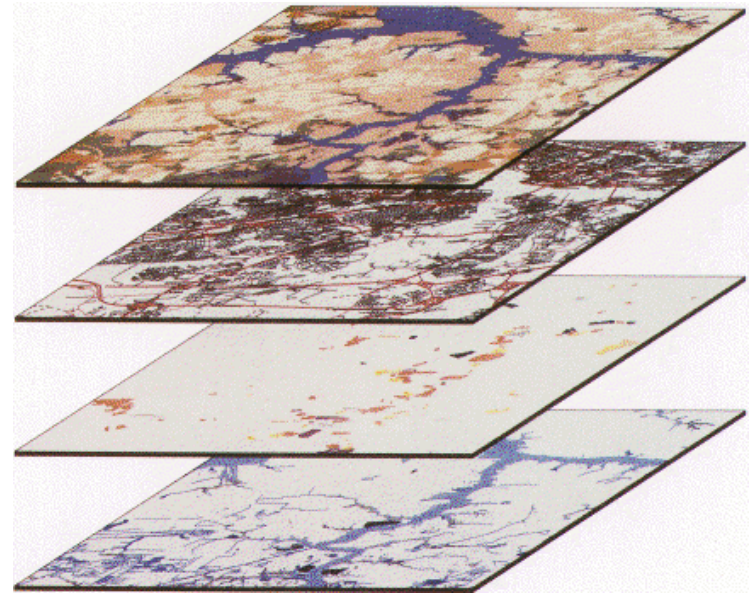
Map the change in an area to anticipate future conditions, decide on a course of action, or to evaluate the results of an action or policy.



## Geospatial Data Types and Formats

Estimates are that 80% of all data has a *spatial* component

- Data from most sciences can be analyzed “spatially”



# Geospatial Data Are ...

Digital representations of real-world features that:

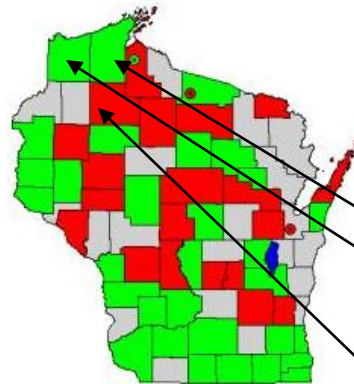
- describe objects and relations among them
- include spatial reference information
- contain both geometric and thematic data
- come in many different formats
- support a wide range of applications
- offer more flexibility than hardcopy maps

## Geospatial Data Types and Formats

# Spatial and Attribute Data

The basic data types in a GIS reflect traditional data found on a map. GIS technology utilizes two basic types of data.

- **Spatial data:**  
describes the absolute and relative location of geographic features.



Attributes of dtl_cnty			
ObjectID	NAME	STATE_NAME	FIPS
4718592	Bayfield	Wisconsin	55007
4718593	Douglas	Wisconsin	55031
4718594	Ashland	Wisconsin	55003
4718595	Iron	Wisconsin	55051
4718596	Vilas	Wisconsin	55125
4718597	Washburn	Wisconsin	55129
4718598	Sawyer	Wisconsin	55113
4718599	Burnett	Wisconsin	55013
4718600	Forest	Wisconsin	55041
4718601	Florence	Wisconsin	55037
4718602	Price	Wisconsin	55099
4718603	Oneida	Wisconsin	55085
4718604	Marinette	Wisconsin	55075

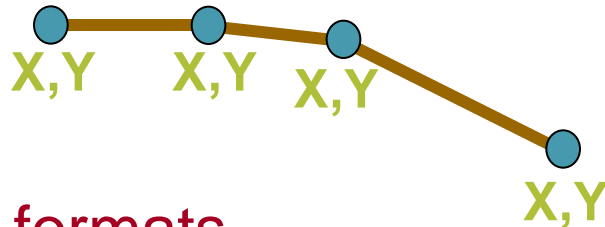
- **Attribute data:**  
Describes characteristics of the spatial features. These characteristics can be quantitative and/or qualitative in nature. Attribute data is often referred to as tabular data.

## Geospatial Data Types and Formats

# Formats: Raster and Vector

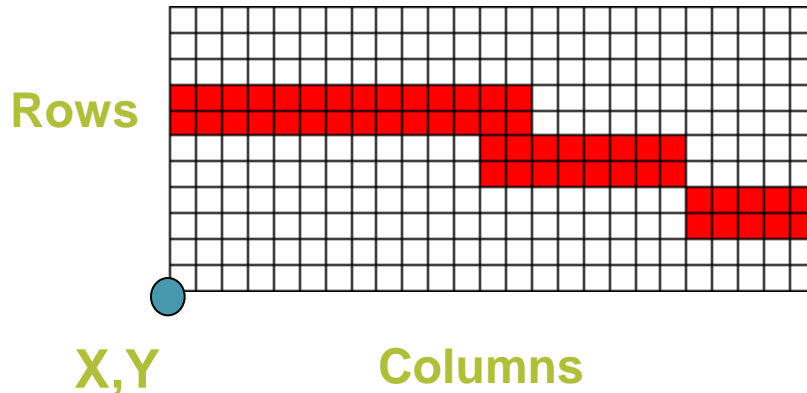
### ■ Vector formats

- Discrete representations of reality



### ■ Raster formats

- Use square cells to model reality



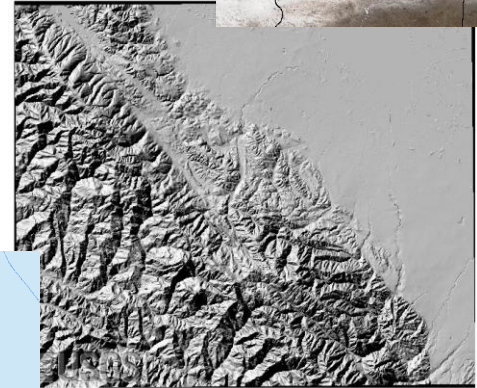
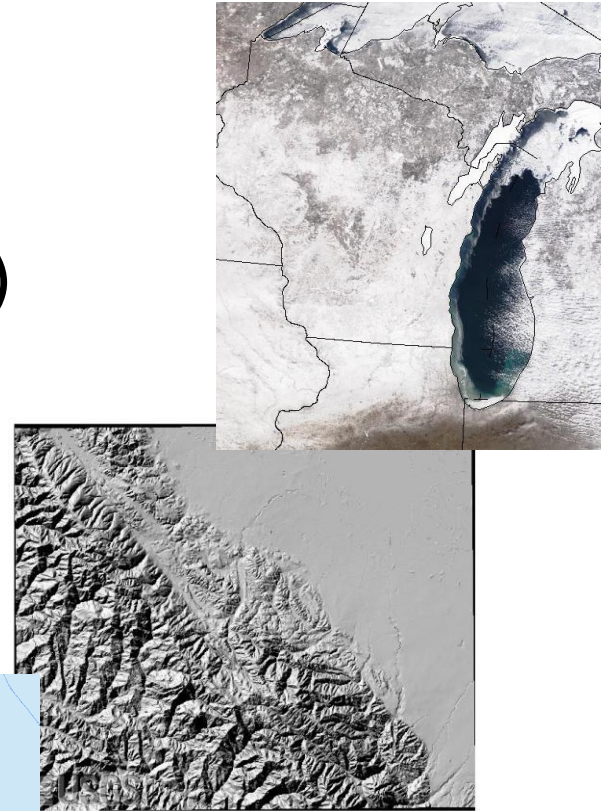
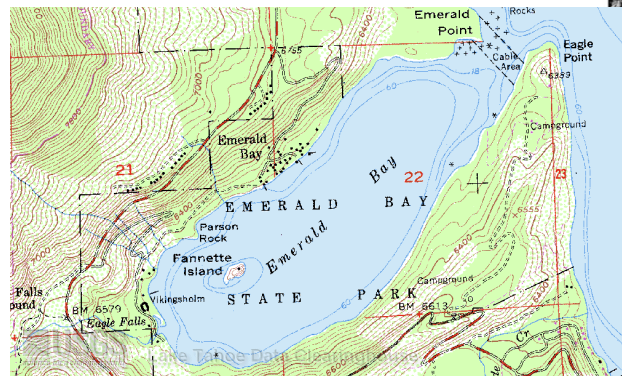
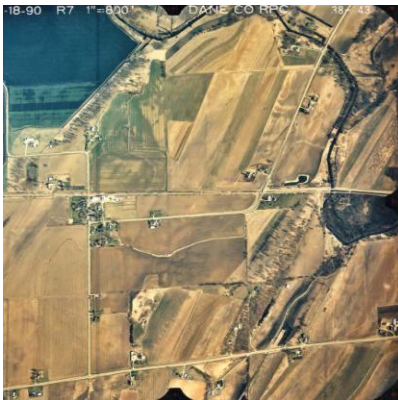
**Reality  
(A highway)**



# Geospatial Data Types and Formats

## Raster examples

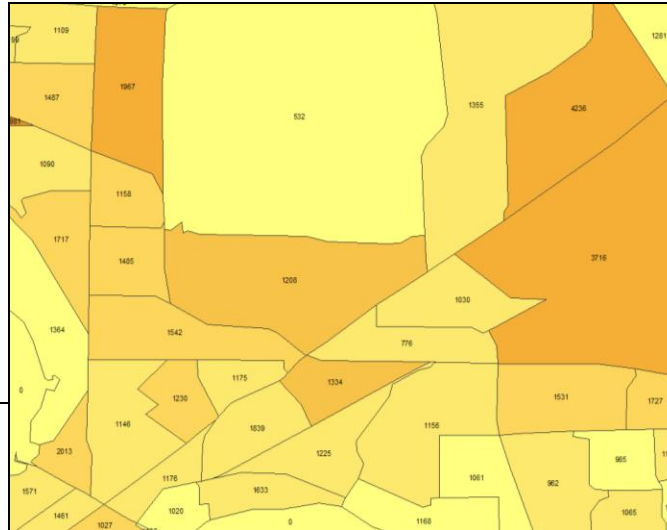
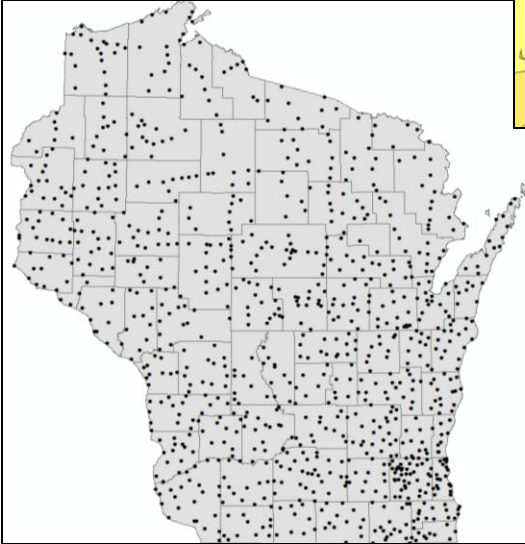
- Orthophotography
- Digital elevation models (DEM)
- Digital raster graphics (DRG)
- Satellite imagery
- Grid (ArcGIS)



# Geospatial Data Types and Formats

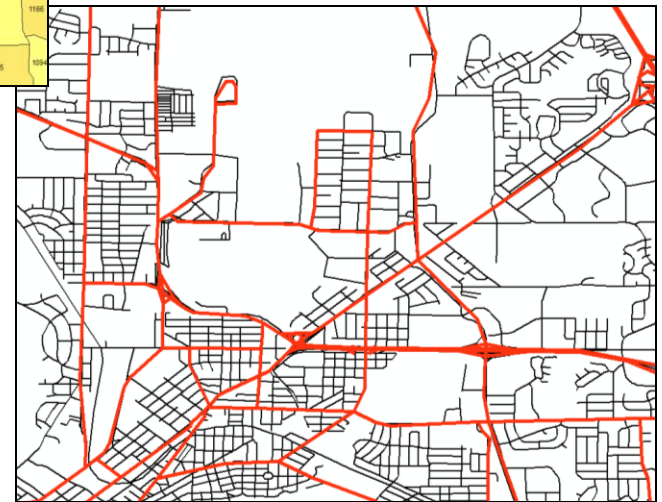
## Vector examples

Cities (points)



Census Block Group  
boundaries (polygons)

Roads (lines)



# Geospatial Data Types and Formats

## Common GIS files

.shp – Shapefile (ESRI)

.mif – MapInfo

.dwg – AutoCAD drawing

.dxf – AutoCAD exchange

.dgn – Bentley Microstation

.e00 – ArcINFO export (ESRI)  
(ESRI coverage)

.tif (TIFF/GeoTIFF)

.dem (Digital Elevation Model)

SDTS (Spatial Data Transfer Standard)







File Geodatabase (.gdb)

Personal Geodatabase (.mdb)



# Geospatial Data Types and Formats

## The Shapefile (an open format)

	StGenAll_D02.dbf	- database (attribute table of descriptive elements for each feature)
	StGenAll_D02.prj	- projection information (coordinate/spatial reference system)
	StGenAll_D02.sbn	- part 1 of the spatial index of features
	StGenAll_D02.sbx	- part 2 of the spatial index of features
	StGenAll_D02.shp	- feature geometry for each shape
	StGenAll_D02.shx	- index of feature geometry

The essential 3 needed to draw the shapefile correctly: .shp; .shx; .dbf

# Projections and Coordinate Systems



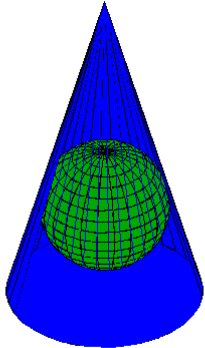
## Projections

- The best model of the earth would be a 3-dimensional solid in the same shape as the earth. (i.e. a globe).
- Globes have several drawbacks:
  - Globes are large and cumbersome.
  - They are generally of a scale unsuitable to the purposes for which most maps are used.
  - Usually we want to see more detail than is possible to be shown on a globe.
- Standard measurement equipment (rulers, protractors, planimeters, dot grids, etc.) cannot be used to measure distance, angle, area, or shape on a sphere, as these tools have been constructed for use in planar models.

# Projections and Coordinate Systems

**Projection surfaces (i.e., cylinders, cones, and planes) form the basic types of projections**

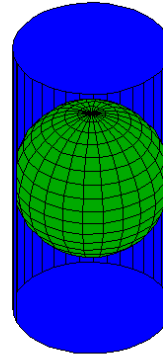
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**Conical Projection Surface**

1. Standard parallels are where the cone touches or slices through the globe.
2. The central meridian is opposite the edge where the cone is sliced open.
3. Conic projections are used frequently for mapping large areas (e.g., states, large countries, or continents).

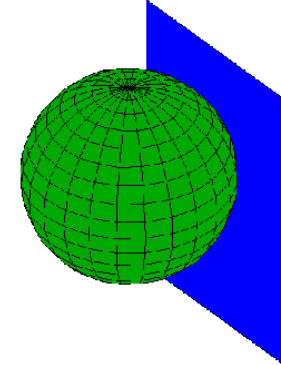
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**Cylindrical Projection Surface**

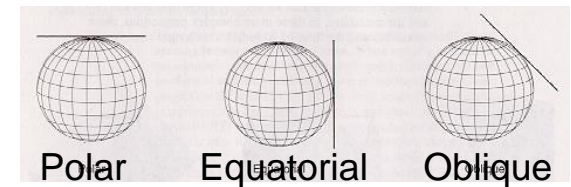
1. The most common cylindrical projection is the Mercator projection, which is the basis of the UTM (Universal Transverse Mercator) system.

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**Planar Projection Surface**

1. Different orthographic projection parameters:



# Projections and Coordinate Systems



Although many different map projections exist, they all introduce distortion in one or more of the following measurement properties:

- Shape
- Distance
- True Direction
- Area

There are names for the different classes of projections that minimize distortion:

- Those that minimize distortion in shape are called **conformal**.
- Those that minimize distortion in distance are known as **equidistant**.
- Those that minimize distortion in area are known as **equal-area**.
- Those minimizing distortion in direction are called **true-direction** projections.

# Projections and Coordinate Systems

- Once map data are projected onto a planar surface, features must be referenced by a planar coordinate system.
- The geographic system (latitude-longitude), which is based on angles measured on a sphere, is not valid for measurements on a plane.
- A Cartesian coordinate system is used, where the origin (0, 0) is toward the lower left of the planar section.
- Coordinates in the GIS are measured from the origin point. However, **false eastings** and **false northings** are frequently used, which effectively offset the origin to a different place on the coordinate plane. This is done in order to achieve several purposes:
  - Minimize the possibility of using negative coordinate values (to make calculations of distance and area easier).
  - Lower the absolute value of the coordinates (to make the values easier to read, transcribe, calculate, etc.).



# Projections and Coordinate Systems

**The two most common coordinate/projection systems in the USA are:**

- **State Plane**

- The state plane system includes different projections for each state, and frequently different projections for different areas *within* each state.
- The State Plane system was developed in the 1930s to simplify and codify the different coordinate and projection system for different states within the USA.

- **Universal Transverse Mercator (UTM)**

- A particular subset of the transverse Mercator is the Universal Transverse Mercator (UTM) which was adopted originally by the US Army for large-scale military maps.
- In the UTM system, the globe is divided into 60 zones between 84° S and 84° N, most of which are 6° wide. Each UTM zone has its own central meridian and spans 3° west and 3° east from the center of the zone.

# Geospatial Metadata

## GIS metadata Standards

- Purpose:
  - Describe the content, quality, condition
  - Help users locate and understand data
- Use:
  - Maintain organization's investment
  - Provide information to clearinghouses
  - Provide information for data transfer

## Geospatial Data Collections

# Geospatial Metadata – sample FGDC record

### Dane County (WI) Digital Orthophotography

Metadata also available as - [\[Questions & Answers\]](#) - [\[Parseable text\]](#) - [\[XML\]](#)

#### Metadata:

- [Identification Information](#)
- [Data Quality Information](#)
- [Spatial Data Organization Information](#)
- [Spatial Reference Information](#)
- [Entity and Attribute Information](#)
- [Distribution Information](#)
- [Metadata Reference Information](#)

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#### Identification Information:

##### *Citation:*

##### *Citation Information:*

*Originator:* Dane County Land Information Office

*Publication Date:* 1995

*Title:* Dane County (WI) Digital Orthophotography

##### *Publication Information:*

*Publication Place:* Madison, WI

*Publisher:* Dane County Land Information Office

##### *Description:*

##### *Abstract:*

The orthophotos are a raster data set derived from 1:31,680 scale aerial photography that was flown in the spring of 1995. It was flown to provide full 1-meter coverage of the county, replacing the 2-meter USGS digital orthophoto quarterquad mapping that covered only part of the county. The data are divided into 35 township-based data sets.

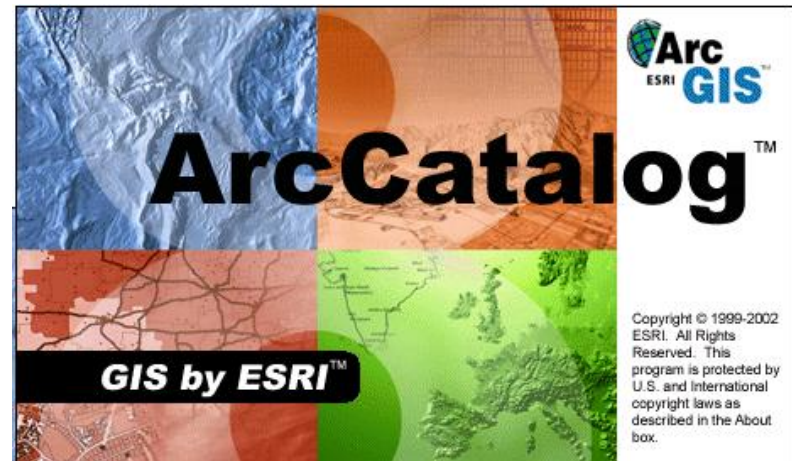




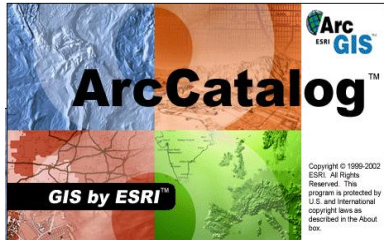
## GIS Software

# ArcGIS

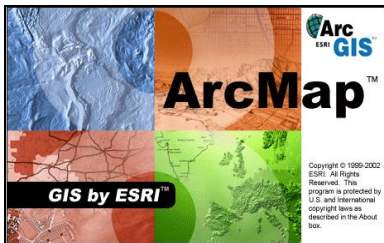
- One suite with three applications
- ArcGIS capabilities vary depending on license type
  - ArcView, ArcEditor, ArcInfo



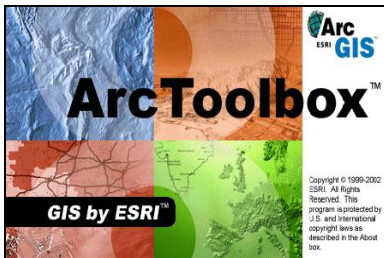
# GIS Software



With **ArcCatalog**, you can view GIS data holdings, preview geographic information, view and edit metadata, and work with tables.

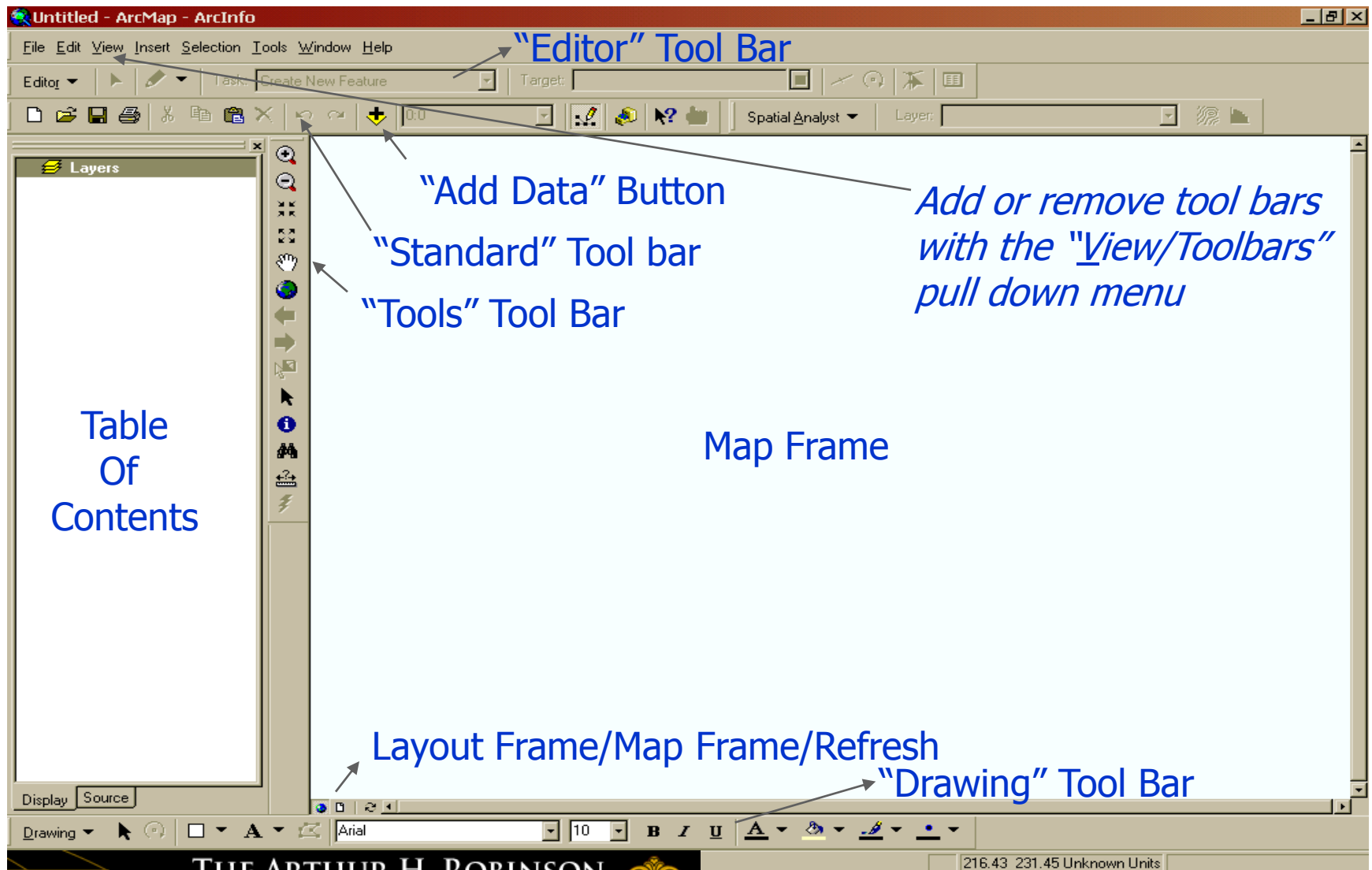


**ArcMap** is the desktop application for all map-based tasks including cartography, map analysis, and editing. ArcMap allows you to: **Visualize** data, **Create** maps, **Solve** problems, **Present** analysis & **Develop** results



**ArcToolbox** is an application containing many GIS tools used for geoprocessing as well as file conversion, manipulation, and editing.

# GIS Software



# Geographic Information Systems: Agricultural Applications

## Part I: Data Sources and Web Mapping Services





# Agricultural Applications – Part I: Data Sources and WMS

USDA – Census of Agriculture:

<http://www.agcensus.usda.gov/Publications/2002/index.asp>

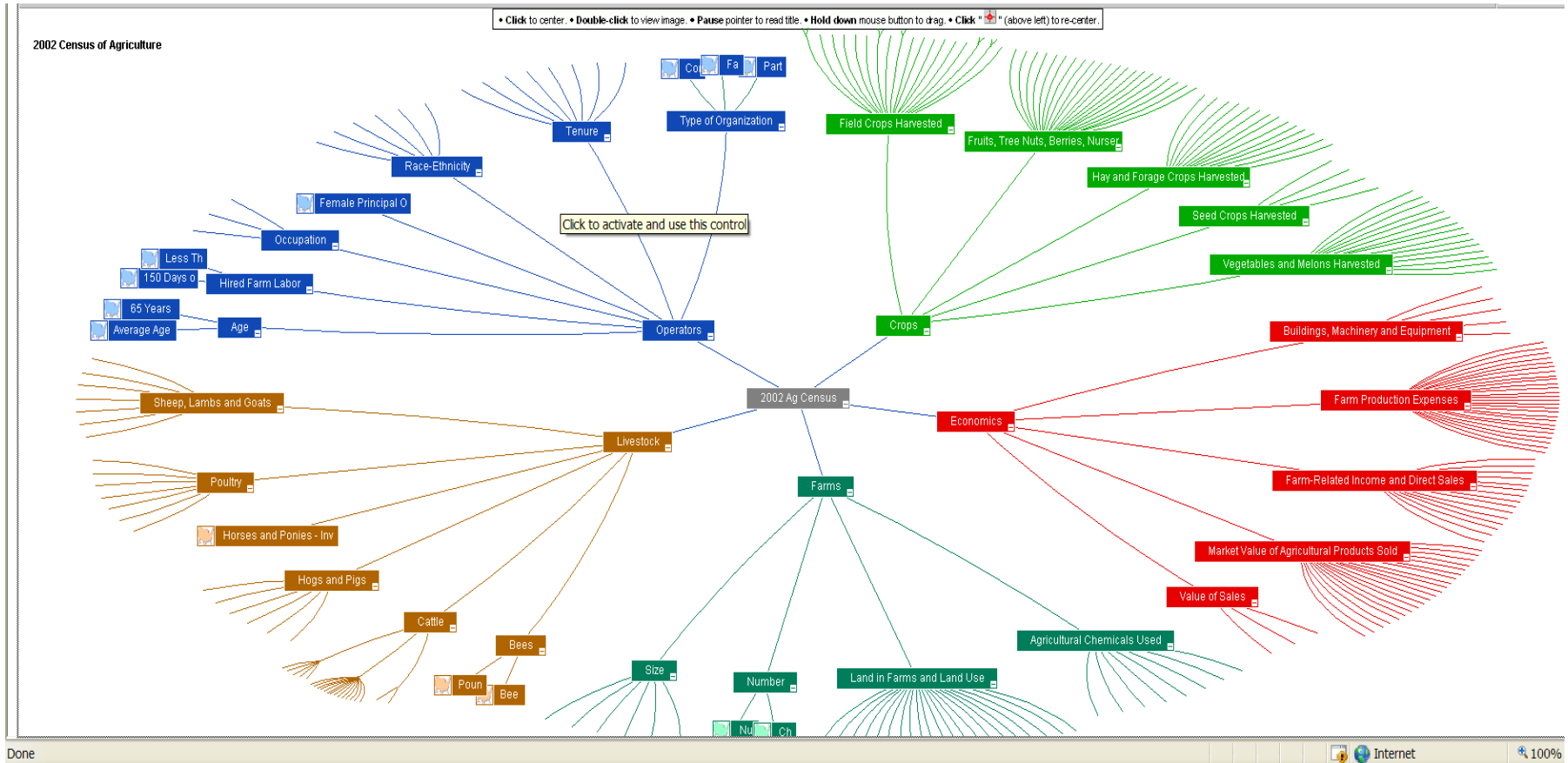
The screenshot shows the USDA Census of Agriculture website. The header includes the USDA logo and the title "The Census of Agriculture National Agricultural Statistics Service". A navigation bar contains links: Home, Take the Census, About the Census, Newsroom, Publications, Help, Contact Us, and NASS home. A search box on the left is titled "Search the Census" and includes a "Go" button and a dropdown menu for "Ag. Census". Below the search box are links for "Advanced Search" and "Search Tips". A "Census Years" section lists links for 2007, 2002, 1997, 1992, and Historical Years. A "Census by State" section has a "Select a State" dropdown. The main content area is titled "2002 Census Publications" and includes a "Census Quick Stats" section with a "U.S. - State" dropdown and a "Go" button. Below this is a "Geographic Area Series Publications" section with links for "2002 U.S. Summary and State Reports" (U.S. by Table, All States by Table) and "2002 State and County Reports" (State Level by Table, All Counties by State by Table). There is also an "Outlying Areas" section with links for American Samoa, Puerto Rico, Profiles by Municipios, Commonwealth of the Northern Mariana Islands, Guam, and Virgin Islands. A "Specialty Products and Special Studies" section lists various reports and maps. On the right side, there is a "Related Information" section with links for "2002 Report Forms & Instructions", "Report Form Guide", "Dates for Ag Census Reports", "Frequently Asked Questions", "Data Documentation", and "C-FARE Review of the 2002 Census of Agriculture". Below this is a "Census by State" section with a "Select a State" dropdown and a note about viewing 2002 Census of Agriculture material by state. A "Media Help" section includes a note about viewing PDF files and a link to "Click here to respond online to the 2007 census" with a mouse icon.



# Agricultural Applications – Part I: Data Sources and WMS

## USDA – Census of Agriculture

<http://www.nass.usda.gov/research/atlas02/atlas-info.html>



# Agricultural Applications – Part I: Data Sources and WMS

NRCS Geospatial Data Gateway: <http://datagateway.nrcs.usda.gov/>

Internet Explorer users must check java options and use JRE 1.5 (or higher) before proceeding. (see FAQ item 2)

USDA + United States Department of Agriculture + Service Center Initiative +

Get Data Login Check Order Status Maps News FAQ About Contact Administration

+ Natural Resources Conservation Service +  
+ Farm Service Agency +  
+ Rural Development +

the one stop source of  
**natural resources data**

The Geospatial Data Gateway provides One Stop Shopping for natural resources or environmental data at anytime, from anywhere, to anyone. **The Gateway** allows you to choose your area of interest, browse and select data from our catalog, customize the format, and have it downloaded or shipped on CD or DVD.

**SYSTEM STATUS**

**MONDAY, 1-28-2008 7:30AM MST**  
All NAIP and CLU products are currently unavailable due to issues at the data provider.

All soils products are temporarily unavailable. They should return Monday 28-Jan-08.

Effective 13-DEC-06, JRE 1.5 (or higher) is **REQUIRED** for Step 1 and 2. The JRE can be downloaded and installed [here](#). In addition, see [FAQ #2](#) on how to configure your browser.

**Geospatial Data Gateway**

**Minimum Requirements:** Microsoft Internet Explorer 5.5 or Netscape Communicator 4.76 with Java enabled.

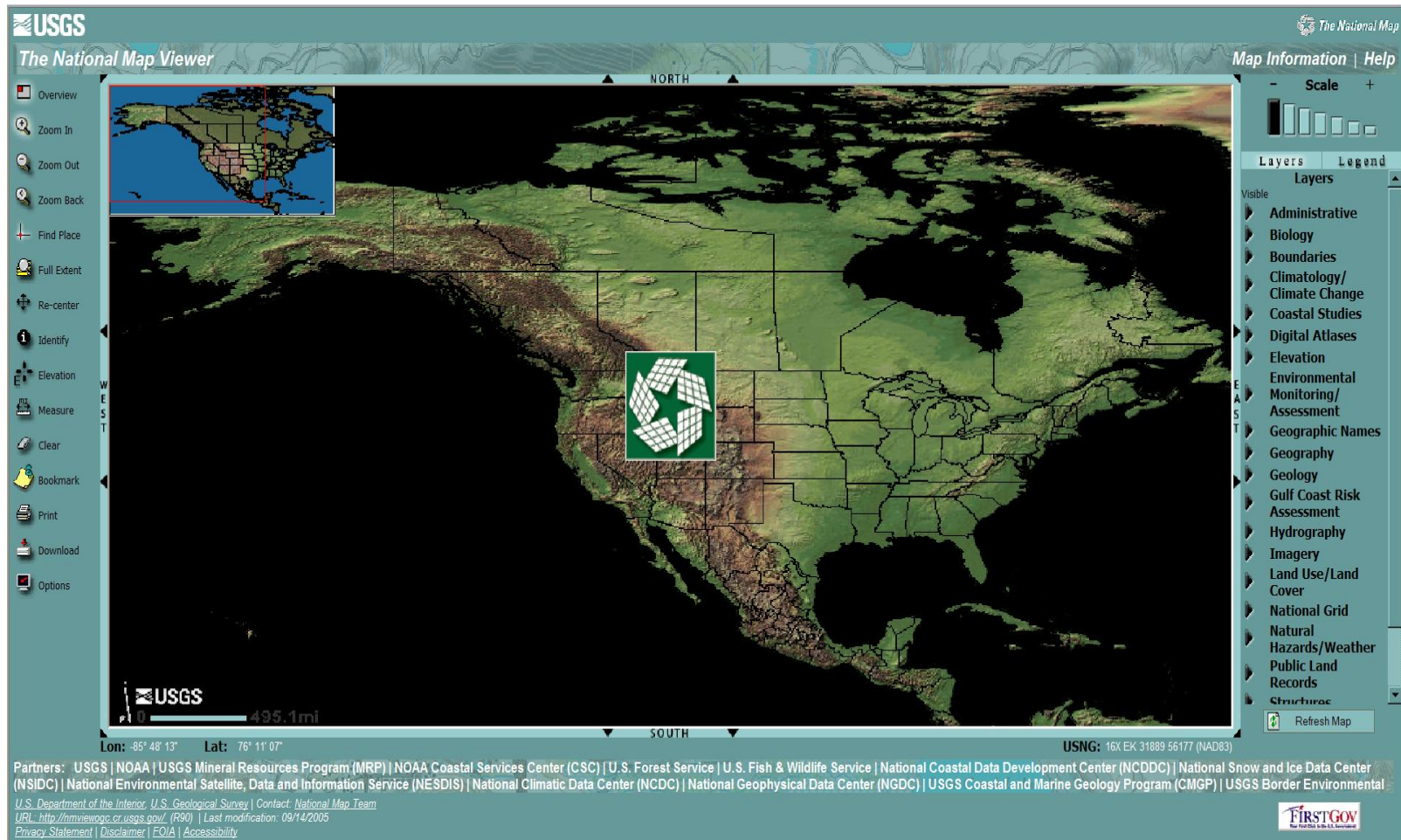
**WARNING:** This is a United States Department of Agriculture computer system, which may be accessed and used only for official Government business (or as otherwise permitted by regulation) by authorized personnel. Unauthorized access or use of this computer system may subject violators to criminal, civil, and/or administrative action. All information on this computer system may be intercepted, recorded, read, copied, and disclosed by and to authorized personnel for official purposes, including criminal investigations. Access or use of this computer system by any person, whether authorized or unauthorized, constitutes consent to these terms.

USA.gov FOIA Non-Discrimination Statement Privacy Policy Disclaimer Data Distribution Policy

# Agricultural Applications – Part I: Data Sources and WMS

USGS – The National Map

<http://nationalmap.gov/>



THE ARTHUR H. ROBINSON  
**MAP LIBRARY**  
University of Wisconsin-Madison



[www.geography.wisc.edu/maplib/](http://www.geography.wisc.edu/maplib/)



# Agricultural Applications – Part I: Data Sources and WMS

## The National Wetlands Inventory “Wetlands Mapper”

<http://wetlandsfws.er.usgs.gov/NWI/index.html>

The screenshot shows the homepage of the U.S. Fish & Wildlife Service's Wetlands Geodatabase. The header features the U.S. Fish & Wildlife Service logo and the text "U.S. Fish & Wildlife Service", "Division of Habitat and Resource Conservation", and "Wetlands Geodatabase". Below the header, there is a "link to NWI" button. The main content area is titled "Wetlands Digital Data" and includes a "Click here" button with a green plant icon and a "Go to Wetlands Mapper" button. The text reads: "Build, search, query, and download custom digital maps and data in the area you choose:". Below this, there are links for "Go to the Wetlands Mapper", "Download Wetlands Digital Data", and "New! Viewing Wetlands data layers with Google Earth". A paragraph states: "Digital data available on this site represent the latest, most accurate information available from the U.S. Fish and Wildlife Service's National Wetlands Inventory. These data are also available on The National Map." At the bottom of the main content area, there are logos for "The National Map", "Geospatial One-Stop", and "FIRSTGOV". The left sidebar contains a "Wetlands Digital Data" section with links for "Wetlands Mapper" and "Download Wetlands Data", a "Wetlands Mapper Information" section with links for "Introduction", "Layers and Metadata", "History and Changes", "Map Creation and Mapper", "Display", "Wetlands Codes", "OGC Web Map Service", "Disclaimer", "Supplemental Information", "MGD Info Quality Guidelines", "Attribution and Verification", and "Tools", a "Mapping Information" section with links for "Product Summary", "Wetlands Definition and Classification", "Data Limitations and Used", and "Contributed Wetlands Data", a "Regional Map Information" section with links for "NWI Regions and Contacts", "NWI Status Information", "Cooperative Distribution", and "Centers", and a "Wetlands Information" section with links for "Wetlands Information" and "Homepage". The bottom of the sidebar has a "Status and Trends" section with a link for "Wetlands Status and Trends". The footer of the page shows the URL "http://wetlands.fws.gov/" and the Internet Explorer browser interface.

U.S. Fish & Wildlife Service  
Division of Habitat and Resource Conservation  
**Wetlands Geodatabase**  
*Providing Wetland Information to the American People*

[link to NWI](#)

**Wetlands Digital Data**

[Click here](#)  
[Go to Wetlands Mapper](#)

Build, search, query, and download custom digital maps and data in the area you choose:

[Go to the Wetlands Mapper](#)

[Download Wetlands Digital Data](#)

[New! Viewing Wetlands data layers with Google Earth](#)

Digital data available on this site represent the latest, most accurate information available from the U.S. Fish and Wildlife Service's National Wetlands Inventory. These data are also available on [The National Map](#).

[The National Map](#) [Geospatial One-Stop](#) [FIRSTGOV](#)

**Wetlands Digital Data**  
[Wetlands Mapper](#)  
[Download Wetlands Data](#)

**Wetlands Mapper Information**  
[Introduction](#)  
[Layers and Metadata](#)  
[History and Changes](#)  
[Map Creation and Mapper](#)  
[Display](#)  
[Wetlands Codes](#)  
[OGC Web Map Service](#)  
[Disclaimer](#)  
[Supplemental Information](#)  
[MGD Info Quality Guidelines](#)  
[Attribution and Verification](#)  
[Tools](#)

**Mapping Information**  
[Product Summary](#)  
[Wetlands Definition and Classification](#)  
[Data Limitations and Used](#)  
[Contributed Wetlands Data](#)

**Regional Map Information**  
[NWI Regions and Contacts](#)  
[NWI Status Information](#)  
[Cooperative Distribution](#)  
[Centers](#)

**Wetlands Information**  
[Wetlands Information](#)  
[Homepage](#)

**Status and Trends**  
[Wetlands Status and Trends](#)

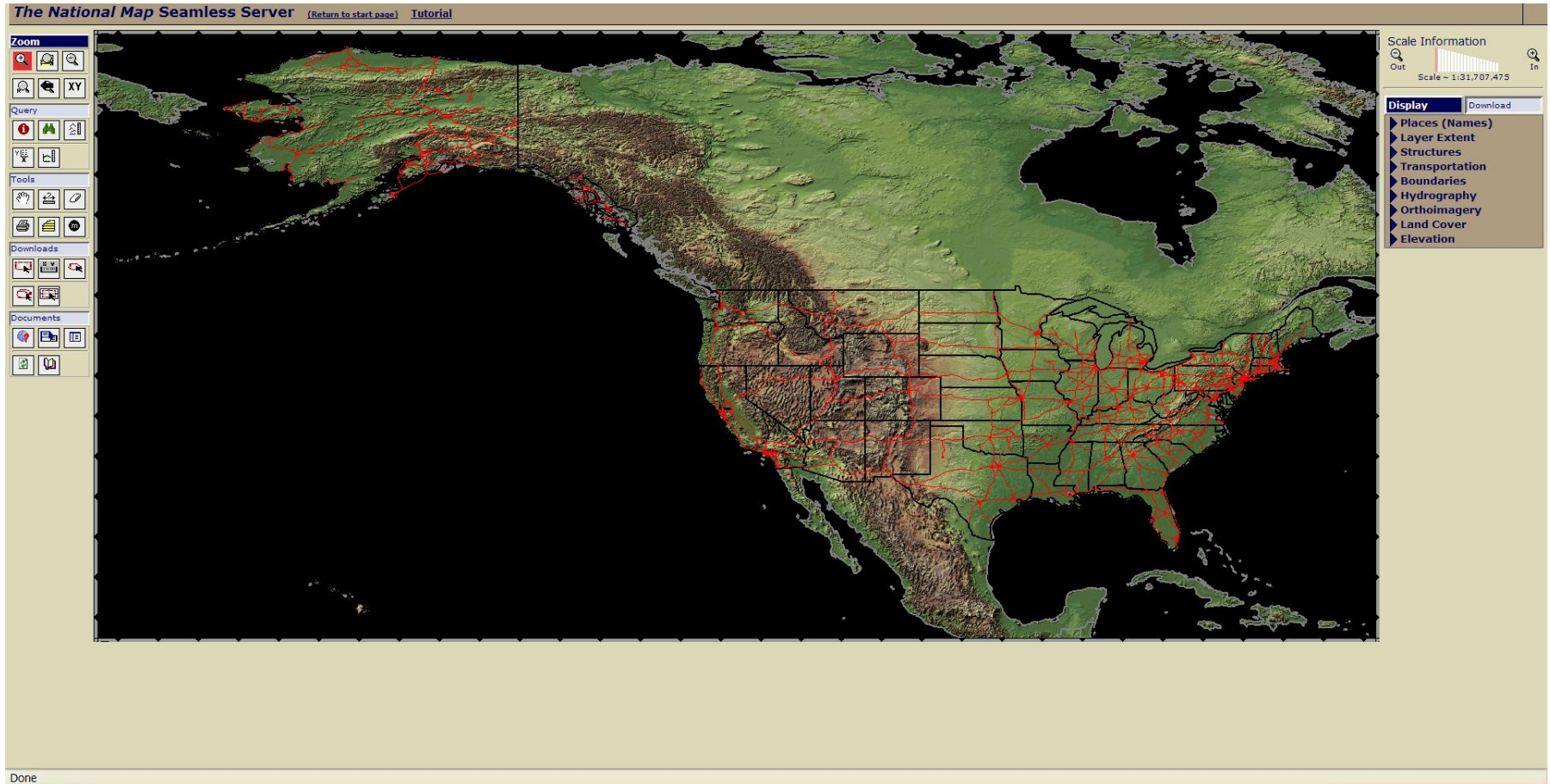
<http://wetlands.fws.gov/>



# Agricultural Applications – Part I: Data Sources and WMS

## USGS – Seamless Data Distribution System

<http://seamless.usgs.gov/website/Seamless/>



## Agricultural Applications – Part I: Data Sources and WMS

**Geodata.gov** – Multi-agency geospatial data clearinghouse  
(Federal Geographic Data Committee) <http://gos2.geodata.gov/wps/portal/gos>  
(Also called “Geospatial One-Stop” or “GOS Portal”)

- Data from federal, state and local agencies is published here in a variety of formats from downloadable data to web mapping services

The screenshot shows the geodata.gov website interface. At the top is a banner with the text "Your One Stop for Federal, State & Local Geographic Data" and navigation links: Home, Search, Maps, Marketplace, Communities, Statistics, and Help Center. Below the banner is a search bar with the text "Search geodata.gov". The main content area is divided into two columns. The left column, titled "Search Results", shows a list of search results. The first result is titled "USDA - NATIONAL AGRICULTURE STATISTICS SERVICE'S 1:100,000-SCALE 2006 CROPLAND DATA LAYER, A Crop-Specific Digital Data Layer for Ohio, Released 2007 September 1". It includes a brief description of the data layer and the publishing organization. The right column, titled "My Geography", shows a map of the United States with a green rectangle indicating the search area. It includes a search bar with the text "Where: (Geographic Footprint, e.g. Harrison, NY)" and buttons for "Find", "More...", and "Reset".

# Agricultural Applications – Part I: Data Sources and WMS

Federal Geographic Data Committee – National Spatial Data Infrastructure (NSDI Clearinghouse) – The “Legacy” search interface (“replaced” by the GOS portal)

<http://www.fgdc.gov/dataandservices/>





## Agricultural Applications – Part I: Data Sources and WMS

USDA APFO (NAIP Imagery): <http://www.fsa.usda.gov/>  
2006 2m resolution aerial photography available in map viewer

Other sources of NAIP photography may be at a local level: (2005-2006)  
For example: **WisconsinView** <http://www.wisconsinview.org/>





# Agricultural Applications – Part I: Data Sources and WMS

NRCS – Web Soil Survey: <http://websoilsurvey.nrcs.usda.gov/app/>

USDA United States Department of Agriculture Natural Resources Conservation Service

## Web Soil Survey

Home About Soils Help Contact Us

You are here: WSS Home

**Search**

Enter Keywords

All NRCS Sites

**Browse by Subject**

- Soils Home
- National Cooperative Soil Survey (NCSS)
- Archived Soil Surveys
- Status Maps
- Official Soil Series Descriptions (OSD)
- Soil Series Extent Mapping Tool
- Soil Data Mart
- Geospatial Data Gateway
- eFOTG
- National Soil Characterization Data
- Soil Geochemistry Spatial Database
- Soil Quality
- Soil Geography
- Geospatial One Stop

The simple yet powerful way to access and use soil data.

**START WSS**

**Welcome to Web Soil Survey (WSS)**

Web Soil Survey and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information.

**Three Basic Steps**

1 Define.

Area of Interest (AOI)

Use the Area of Interest tab to define your area of interest.

**I Want To...**

- Start Web Soil Survey (WSS)
- Know the requirements for running Web Soil Survey
- Know whether my web browser works with Web Soil Survey
- Know the Web Soil Survey hours of operation
- Find what areas of the U.S. have soil data

**Announcements/Events**

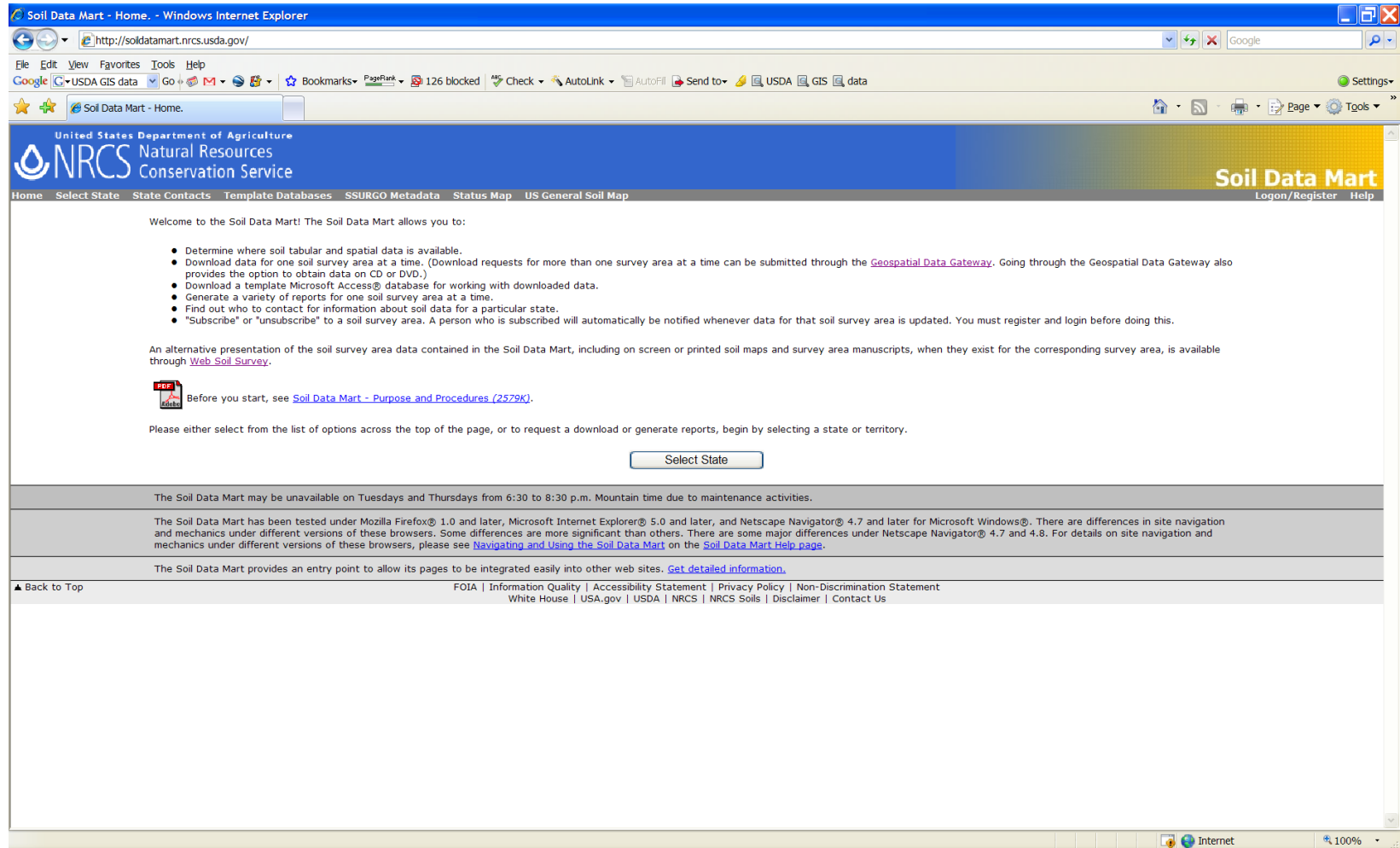
- Web Soil Survey 2.0 has been released! View description of new features.

**I Want Help With...**

- How to use Web Soil Survey
- Known problems and workarounds
- Frequently Asked Questions
- Citing Web Soil Survey

# Agricultural Applications – Part I: Data Sources and WMS

## NRCS – Soil Data Mart (direct download tabular and spatial soils data)



## Agricultural Applications – Part I: Data Sources and WMS

### Local Resources – Who is producing GIS data in your state?

Government agencies and some non-profit organizations across the country produce geospatial datasets focused on local regions, state, county or municipality

Example: Wisconsin DNR

<http://www.dnr.state.wi.us/maps/gis/applist.html>

Example: Dane County, WI

<http://dcimap.co.dane.wi.us/dcimap/index.htm>

Example: University of Wisconsin Extension

<http://www.uwex.edu/>

Wisconsin Land Trusts:

<http://www.gatheringwaters.org/>

## Agricultural Applications – Part I: Data Sources and WMS

### Streaming Web Mapping Services into ArcMap - DEMO

- Image services/Feature services
- “Add GIS Servers” option in ArcMap
- Choose ‘ArcIMS Service’ in most cases

National Map: <http://nmviewogc.cr.usgs.gov>

National Wetlands Inventory: <http://wetlandsfws.er.usgs.gov>

Wisconsin Department of Natural Resources: <http://dnrmaps.wisconsin.gov/>

## Agricultural Applications – Part I: Data Sources and WMS



United States Department of Agriculture  
Natural Resources Conservation Service



# Soil Data Viewer



Contact Us

### Welcome to the Soil Data Viewer Site

**Soil Data Viewer** is a tool built as an extension to ArcMap that allows a user to create soil-based thematic maps. The application can also be run independent of ArcMap, but output is then limited to a tabular report.

The soil survey attribute database associated with the spatial soil map is a complicated database with more than 50 tables. Soil Data Viewer provides users access to soil interpretations and soil properties while shielding them from the complexity of the soil database. Each soil map unit, typically a set of polygons, may contain multiple soil components that have different use and management. Soil Data Viewer makes it easy to compute a single value for a map unit and display results, relieving the user from the burden of querying the database, processing the data and linking to the spatial map.

Soil Data Viewer contains processing rules to enforce appropriate use of the data. This provides the user with a tool for quick geospatial analysis of soil data for use in resource assessment and management.

#### I Want To...

- ◊ [Subscribe to the Soil Data Viewer News](#)
- ◊ [Unsubscribe to the Soil Data Viewer News](#)
- ◊ [Browse the Soil Data Viewer Online User Guide](#)
- ◊ [Browse the Supplemental Documents Available for Soil Data Viewer](#)
- ◊ [Download and Install Soil Data Viewer](#)

[▲ Back to Top](#)      [FOIA](#) | [Information Quality](#) | [Accessibility Statement](#) | [Privacy Policy](#) | [Non-Discrimination Statement](#)  
[White House](#) | [USA.gov](#) | [USDA](#) | [NRCS](#) | [NRCS Soils](#)





# 30 Minute Break

## Agricultural Applications – Part I: Data Sources and WMS

**NRCS – Soil Data Mart** (direct download tabular and spatial soils data)

<http://soildatamart.nrcs.usda.gov/>

**Soil Data Viewer Demonstration**

<http://soildataviewer.nrcs.usda.gov/>

---

**Demonstrations:**

# ArcGIS Explorer & Google StreetView

<http://maps.google.com/>

# ArcGIS 9.2 Exercise

## Thematic Mapping: 2002 Census of Agriculture

# Geographic Information Systems: Agricultural Applications

## Part II: GIS in the Field





## Agricultural Applications – Part II: GIS in the Field



### Field Data Collection

- Hand-held GIS units in the field become the modern day shirt-pocket notebook
- Farmers have the ability to look at images of their fields while they are actually standing in them



## Agricultural Applications – Part II: GIS in the Field



### Farm Management

GIS Applications include:

- the ability to estimate crop yields
- the remote estimation of areas within a field that are suffering a form of stress caused by a specific pest
- the identification of areas of land suffering from soil erosion

## Agricultural Applications – Part II: GIS in the Field



### Creating Data

- Data interpolation: the process of taking many single points and creating a complete surface, the gaps being filled based on the spatial statistics of the original points.
- Point data might include crop yields collected from a combine harvester, soil samples collected manually throughout a farm, or water quality information collected from watering points or wells
- Example: the yield monitor data maps indicate an area with unusually low yields. Geospatial analysis lets the user discover relationships in the same farm field geography that may be the cause of low yields such as slope, moisture, fertility, or poor pesticide performance.

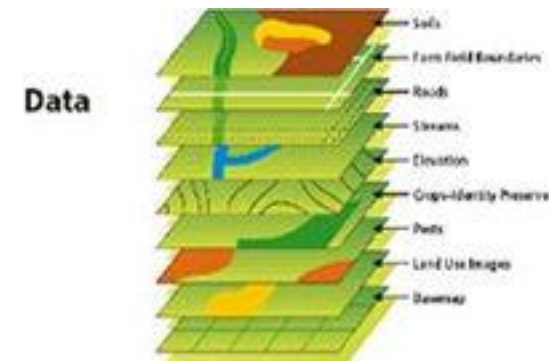


## Agricultural Applications – Part II: GIS in the Field



### Interpreting Results

- A landscape is made up of many interconnected parts, and it is within a GIS that an attempt is made to re-create this complexity within the less complicated structure of a computing environment.
- If the data layers exist at the farm level, calculations can be made to show the total land areas under different crops, the value of cropland for insurance purposes, and the degree of risk associated with different crops should various weather events occur.



## Agricultural Applications – Part II: GIS in the Field



### Maps and Reports

- There are benefits to having all of the farm data readily available as a series of maps, each one telling a specific story to a specialized audience.
- One of the most obvious and immediate outputs from a farm GIS is maps that provide you with new insight.
- Planning applications, filing tax returns, and claiming crop subsidies either require mapped information or are greatly assisted by it.





## Agricultural Applications – Part II: GIS in the Field



### Precision Farming

- Precision farming (PF) and variable rate technologies (VRT) use spatial databases within field environmental and management variables with the aim of evening the application of field inputs while maximizing production across a field. Data is collected in a variety of ways, from handheld GPS units to mobile georeferenced sampling hardware such as tractors and combine harvesters
- Once mapped, this data, which can include soil characteristics, pest locations, drainage systems, and previous harvest yields, can be used to formulate a location-based prescription for the field management in the coming year.



# Geographic Information Systems: Agricultural Applications

## Part III: FSA and GIS methods

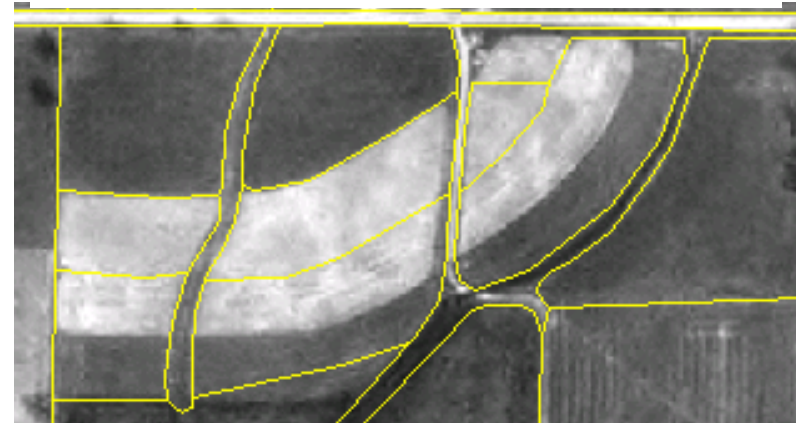


## Agricultural Applications – Part III: FSA and GIS methods

More Accurate and Consistent Crop Acreage Measurement



Orthophotography - CLU

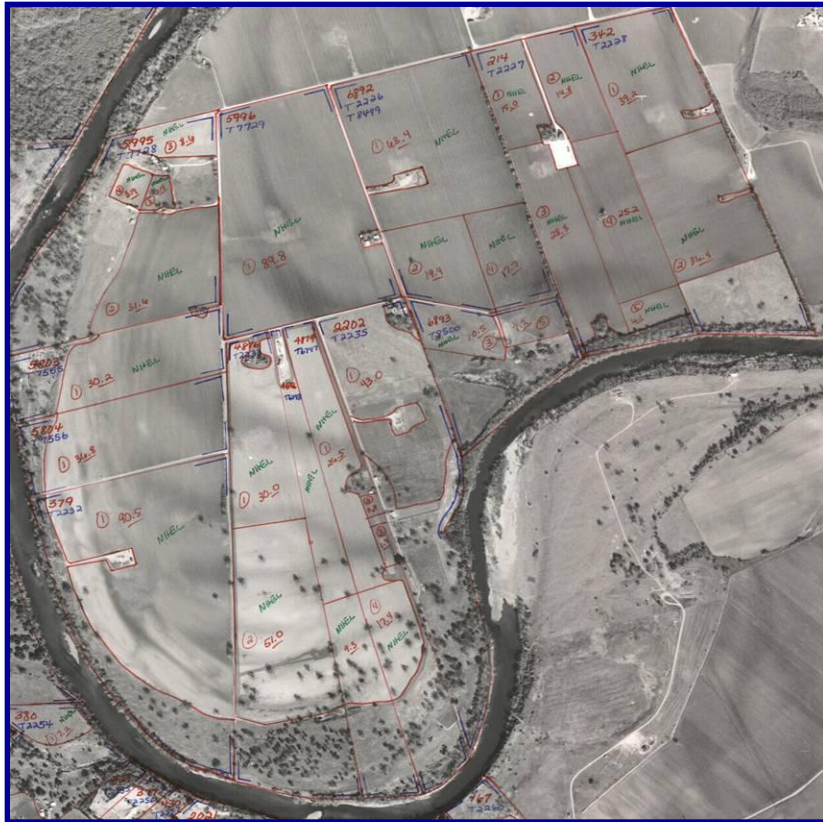




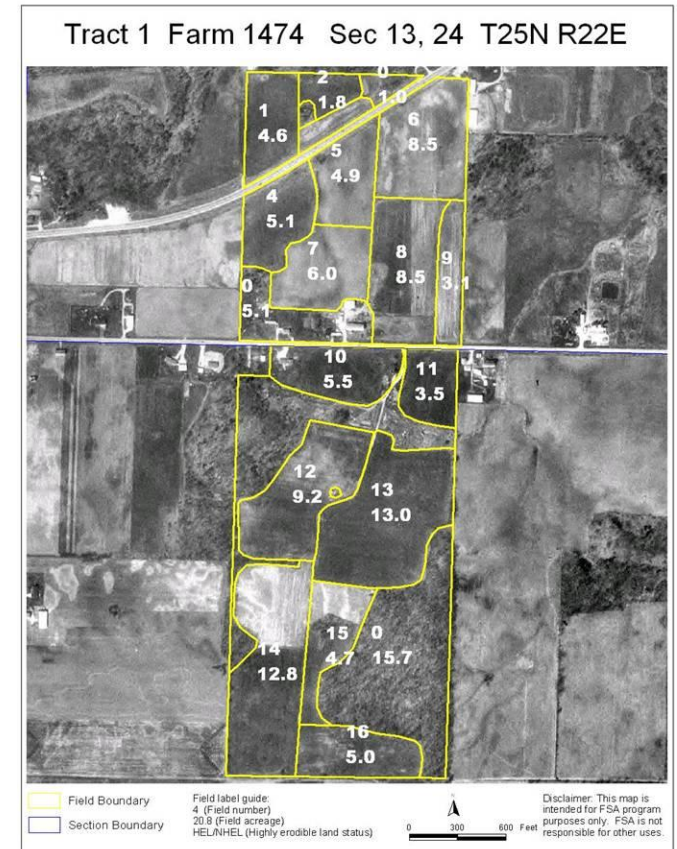
## Agricultural Applications – Part III: FSA and GIS methods

### Better Mapping Products

Old method: Photocopy of Photo Enlargement



GIS: Custom, color map



## Agricultural Applications – Part III: FSA and GIS methods

### Ability to Change Scale



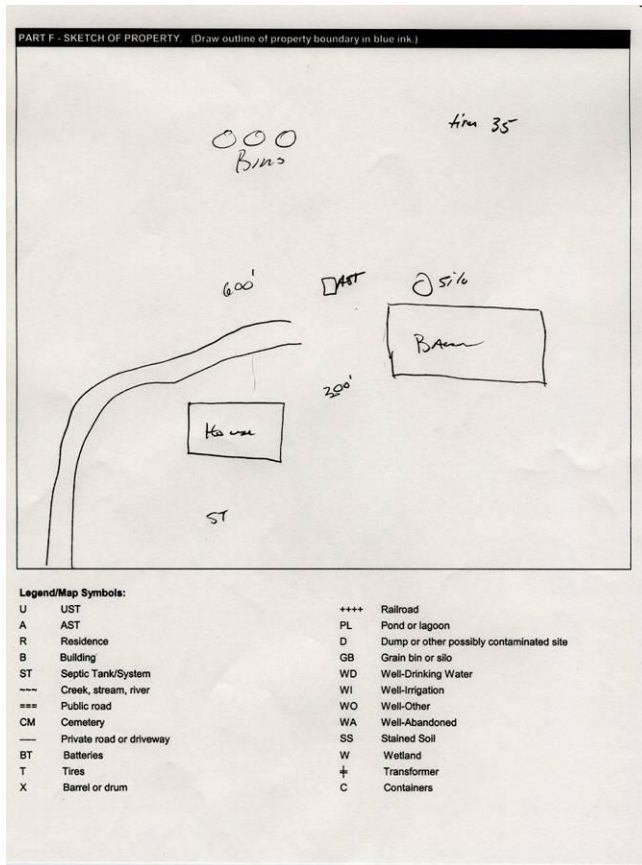


## Agricultural Applications – Part III: FSA and GIS methods

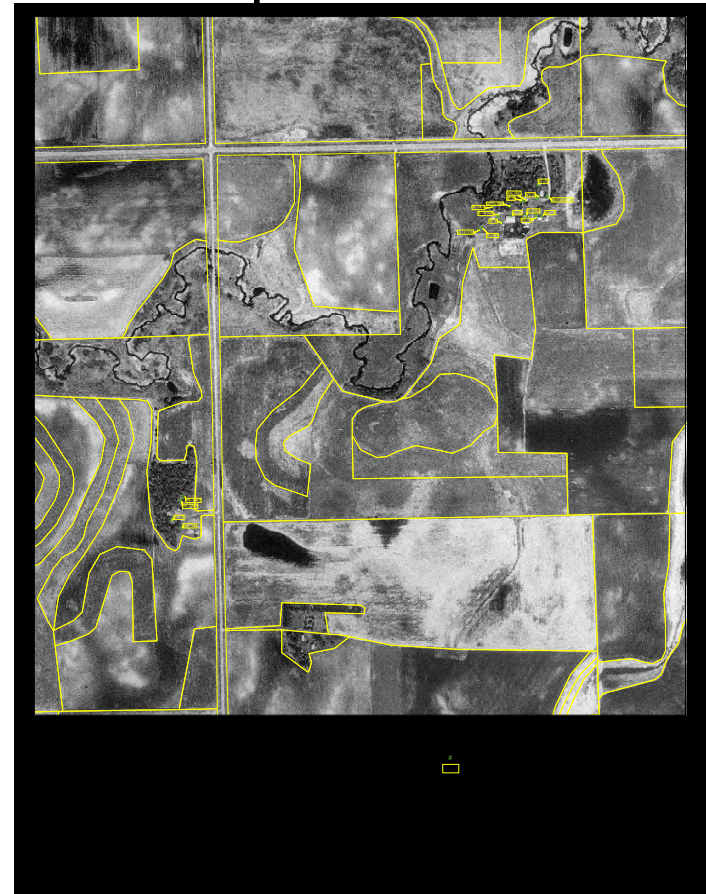
### Farm Appraisals

Source: MN FSA

### Sketch Map



### GIS Map – with GPS linked photos



## Agricultural Applications – Part III: FSA and GIS methods

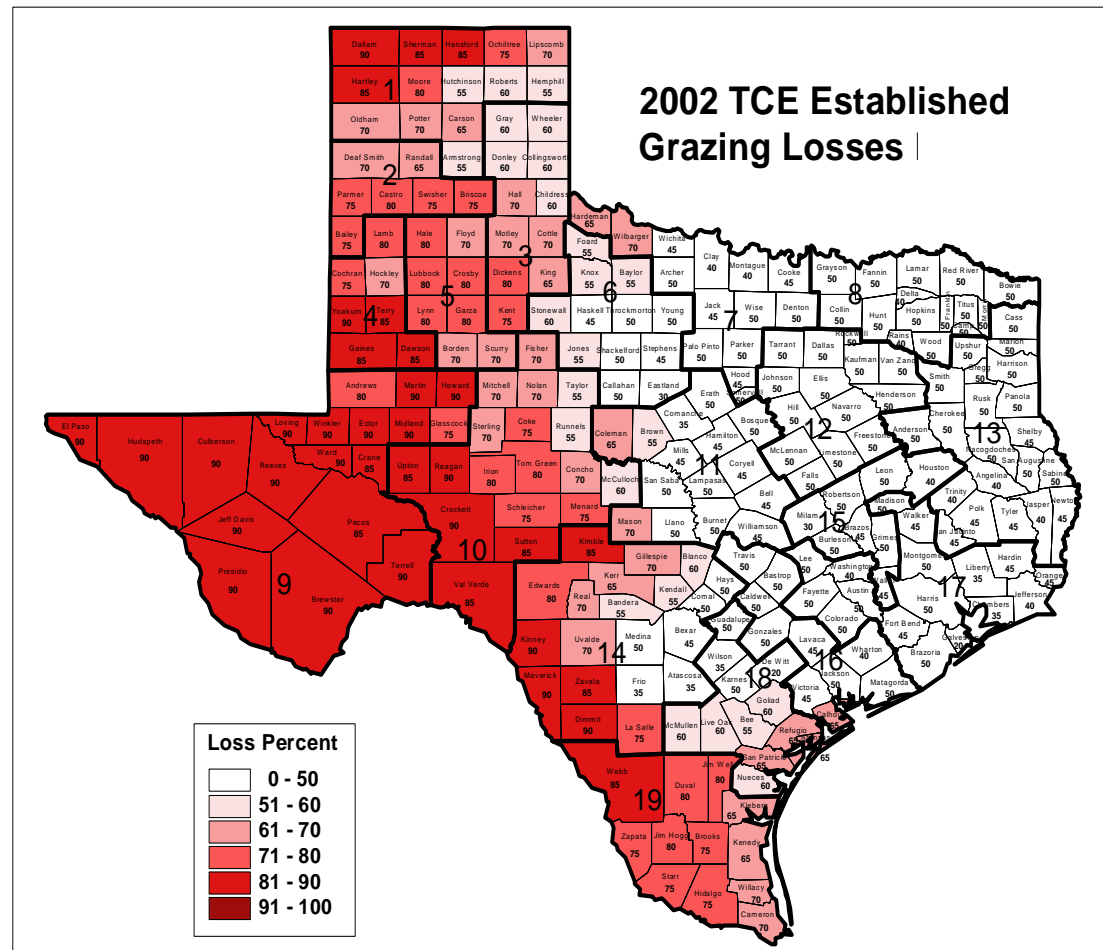
### Cropping History: Linking crop reporting information to the CLU

2003 Reported Crops - Winnebago County



## Agricultural Applications – Part III: FSA and GIS methods

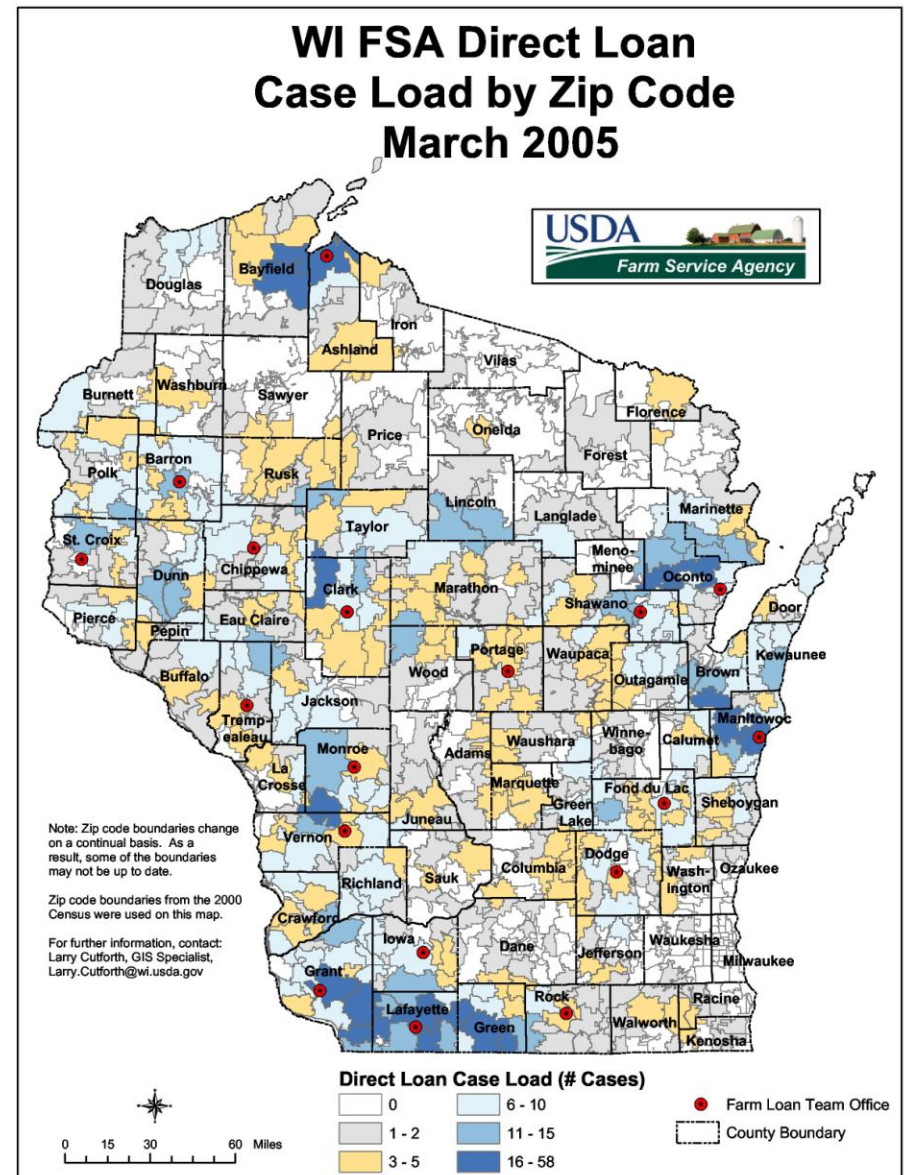
### Visualize Patterns





# Agricultural Applications – Part III: FSA and GIS methods

## Visualizing Patterns

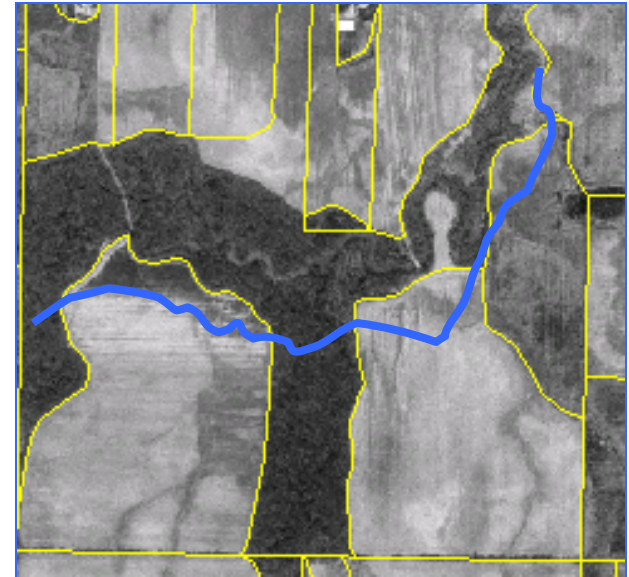


## Agricultural Applications – Part III: FSA and GIS methods



### Integrating and Analyzing Spatial Data

- Application: Contacting landowners for CREP signup.
- Identify all tracts adjacent or bisected by a stream
- Mail maps to tract owners.



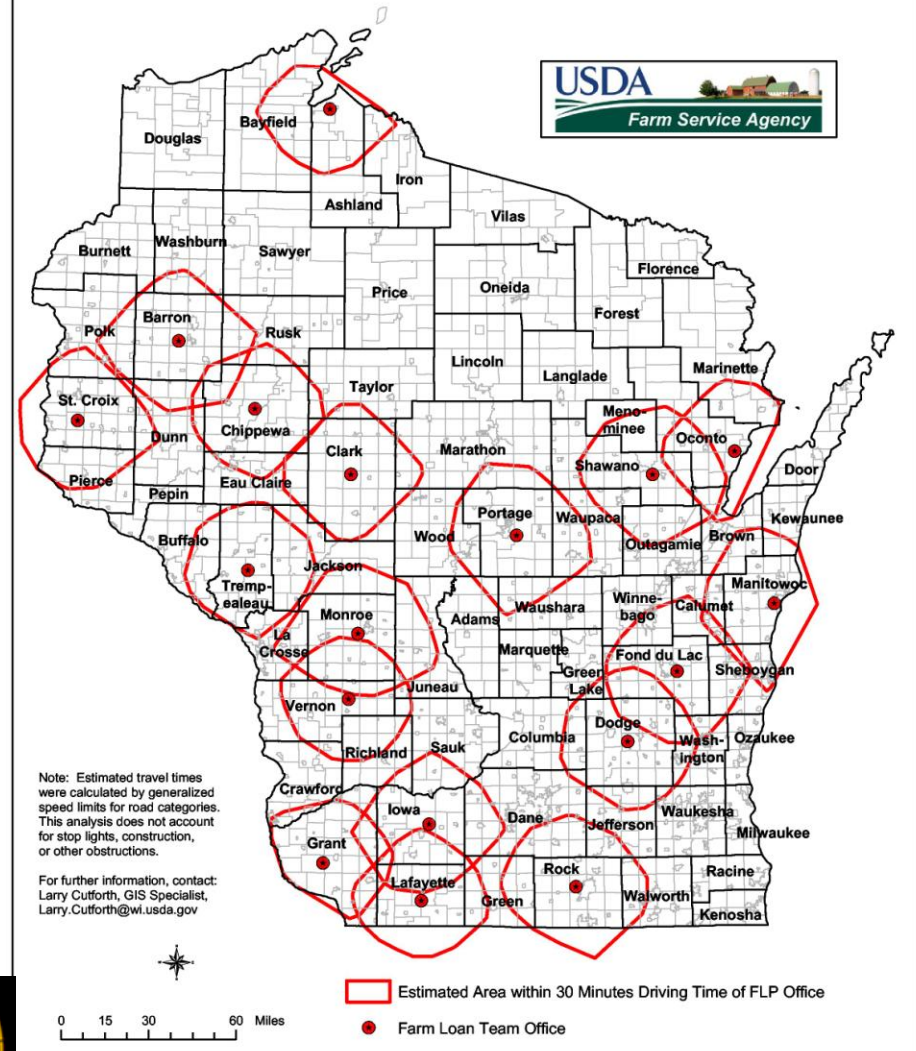
Analysis that integrates CLU with SCIMs and hydrological data.



## Agricultural Applications – Part III: FSA and GIS methods

### GIS Benefits: Travel Time

#### Area within 30 Minutes Travel Time of WI FSA Farm Loan Offices



## Agricultural Applications – Part III: FSA and GIS methods

### Integrating Other Data Sources

- Using remote sensing imagery to estimate the extent of tornado damage



Siren Tornado

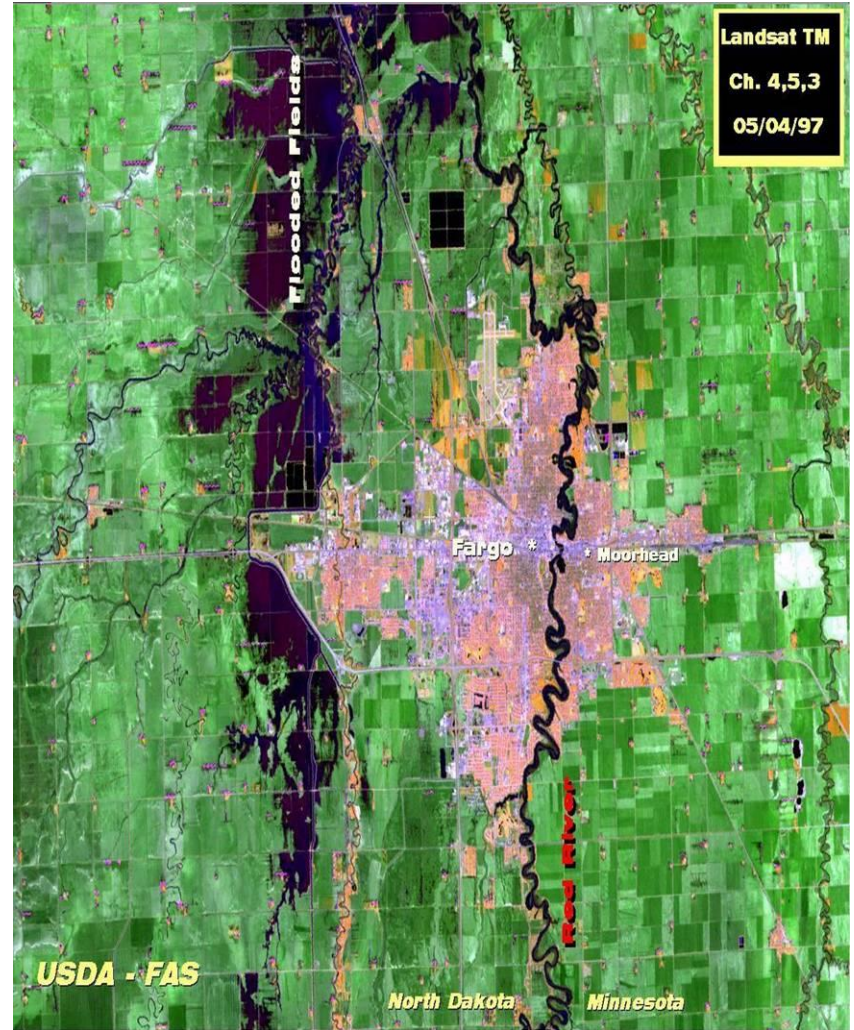
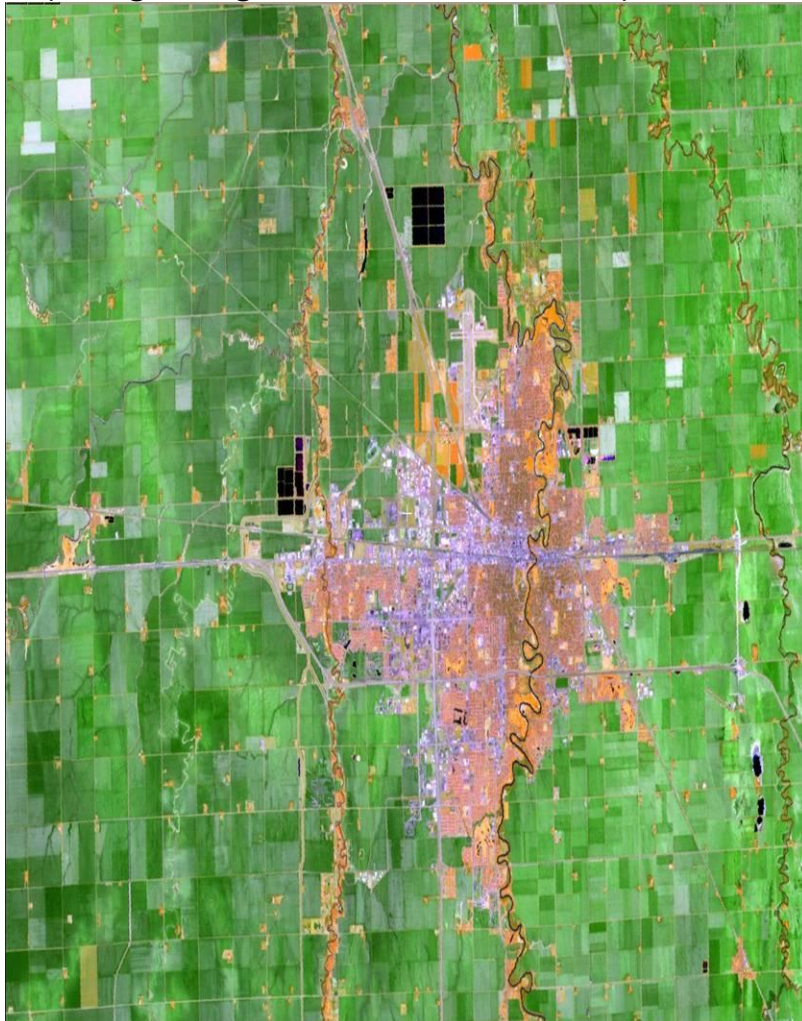
Source:

UW-Madison  
Environmental Remote  
Sensing Center

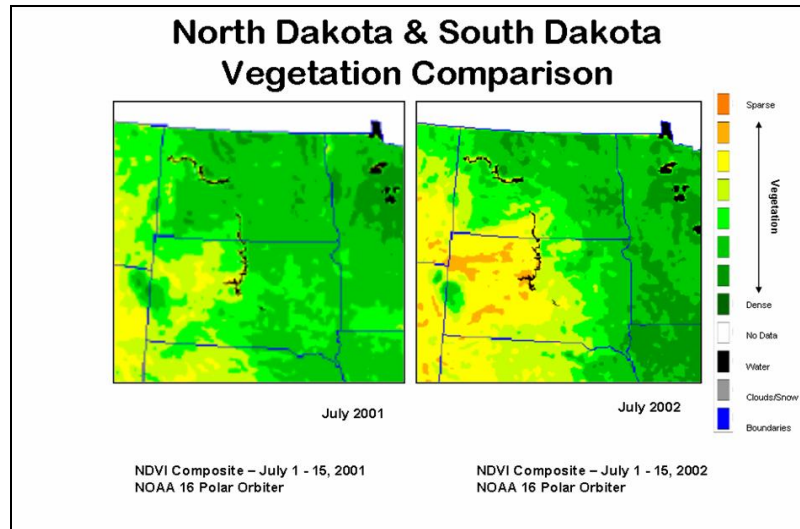


## Agricultural Applications – Part III: FSA and GIS methods

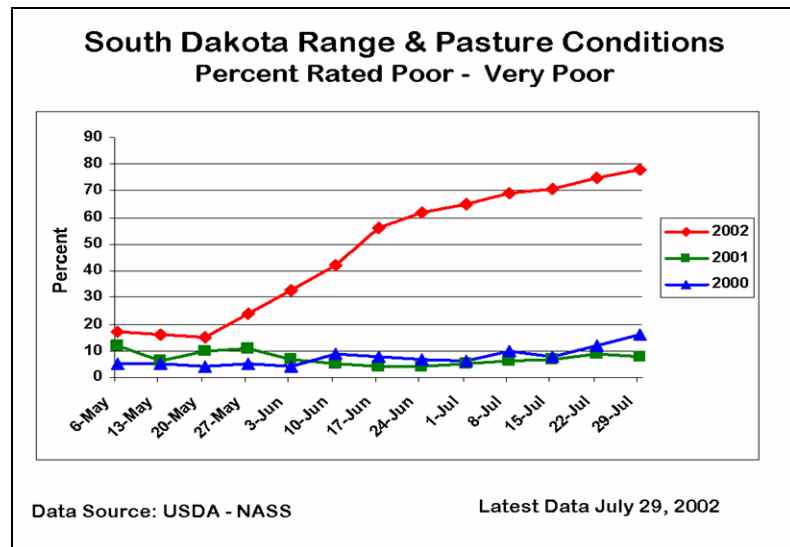
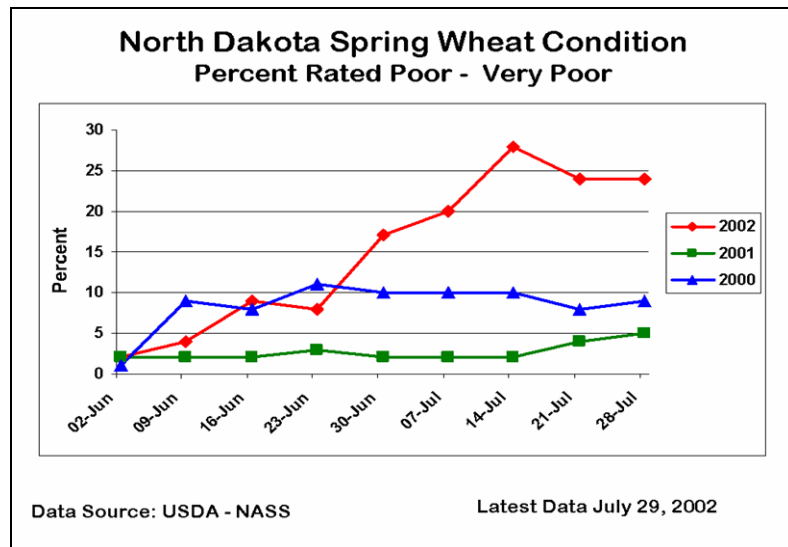
Disaster Area Determination: Fargo flood, 2001  
(Integrating other data sources)



## Agricultural Applications – Part III: FSA and GIS methods



### Crop Conditions



# Questions? Comments?

Jaime Stoltenberg  
[jstoltenberg@wisc.edu](mailto:jstoltenberg@wisc.edu)  
(608) 262-1471